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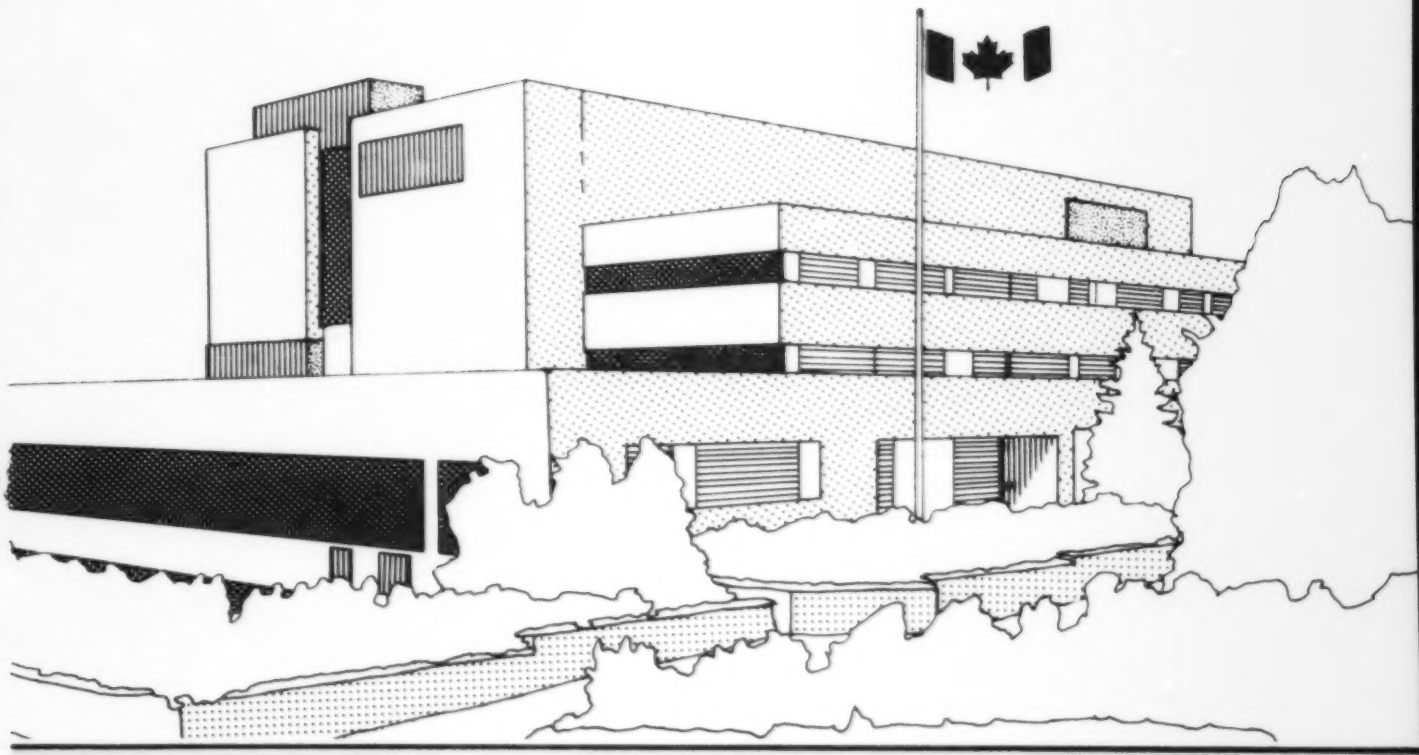
Results of forest insect and disease surveys in the NORTHWESTERN REGION of Ontario, 1988

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

C.G. Jones and E.J. Czerwinski
Miscellaneous Report No. 87



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92-05201/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHWESTERN REGION OF ONTARIO 1988

(FOREST DISTRICTS: RED LAKE, SIOUX LOOKOUT, KENORA, DRYDEN, IGNACE AND FORT FRANCES)

C.G. JONES and E.J. CZERWINSKI

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1989

MISCELLANEOUS REPORT NO. 87

SURVEY HIGHLIGHTS

This report reviews the more important insect, disease and abiotic conditions encountered during aerial and ground surveys of the forested areas in the Northwestern Region of Ontario in 1988.

Spruce budworm continues to be the pest with the most widespread impact on forests in the region; the area of medium-to-heavy infestation totaled 3,389,785 ha and the area within which whole-tree mortality of balsam fir occurred increased to 486,012 ha. The results of egg-mass surveys indicate recurring high populations for the next year.

The expected decrease in population levels of jack pine budworm occurred in all but the Red Lake and Sioux Lookout districts. High population levels were responsible for 736,882 ha of moderate-to-severe defoliation in these districts. As well, approximately 18,000 ha of associated whole-tree and top mortality were mapped in Red Lake District. Egg-mass survey results indicate that high population levels may persist for another year.

Stands of aspen were infested by large populations of two different pests, the forest tent caterpillar in the Dryden, Fort Frances and Kenora districts and the early aspen leafcurler in Red lake District. Ornamentals in the towns of Dryden and Sioux Lookout were once more defoliated by the fall cankerworm.

Armillaria root rot and the western gall rust continue to be major problems in jack pine regeneration.

High winds were responsible for extensive areas of blowdown in the region.

Special surveys done in 1988 included assessments of jack pine in 12 stands for specific insect and disease problems, a collection of 100 jack pine cones from each of two areas and evaluation of pest problems in 11 black spruce seed orchards. Included for the first time is a report on some of the problems encountered at the Dryden Forest Station.

As in previous years, pests in this report are categorized as follows:

Major Insects/Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees,

(2) those that are capable of causing serious damage but, because of low population levels or for other reasons, did not cause serious damage in 1988.

The valuable assistance and cooperation extended to the authors by OMNR and woods industry personnel during the 1988 field season are gratefully acknowledged.

C.G. Jones
E.J. Czerwinski

Frontispiece

Whole-tree mortality of balsam fir (*Abies balsamea* [L.] Mill.) (left) and jack pine (*Pinus banksiana* Lamb.) (right) caused by spruce budworm (*Choristoneura fumiferana* [Clem.]) and jack pine budworm (*Choristoneura pinus pinus* Free.), respectively

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Fall Cankerworm, **Alsophila pometaria** (Harr.)

The fall cankerworm is so named because the moths do not appear until late fall, after the first heavy frosts in October and November. Only the males are capable of flight. Although the insect has numerous deciduous hosts, it shows a preference for Manitoba maple (**Acer negundo** L.). Population increases were observed in two areas in 1988 with moderate-to-severe defoliation of ornamental Manitoba maple recorded in the towns of Dryden and Sioux Lookout. Individual tree defoliation ranged from 5 to 80% but averaged 40% over all in each town. Comparable damage levels at these two sites were last reported in 1985.

Eastern Spruce Budworm, **Choristoneura fumiferana** (Clem.)

Provincial Situation

Spruce budworm again dominated the provincial pest situation as the most widespread destructive forest insect in 1988. The overall area of medium-to-heavy infestation, confined solely to the Northwestern and North Central administrative regions of Ontario, decreased by 30% to 5,224,734 ha in 1988 (Fig. 1). Whole-tree and top mortality of balsam fir (**Abies balsamea** [L.] Mill.) and white spruce (**Picea glauca** (Moench) Voss) in the province, associated with the latest infestation, increased by 448,637 ha, to 14,515,719 ha. This cumulative total includes the first record of tree mortality produced by this latest outbreak, which was recorded in 1971 in Algonquin Region.

A protection spray program was carried out by the Ontario Ministry of Natural Resources (OMNR) in the North Central Region, where 14,023 ha of Crown forests were aerially sprayed with the bacterial insecticide **Bacillus thuringiensis** (B.t.). No spray program against spruce budworm was initiated in the Northwestern Region.

Northwestern Region

Spruce budworm development in the Northwestern Region progressed ahead of normal as a result of above-normal temperatures in May and June (cf. Table 23).

Over all, the area of moderate-to-severe defoliation in the region decreased by 161,122 ha, to 3,389,785 ha. A breakdown of changes in the area infested by district is reported in Table 1, which indicates that decreased populations were recorded in the Fort Frances, Ignace and Sioux Lookout districts. The largest area of population collapse (221,762 ha) occurred in the eastern portion of Fort Frances District,

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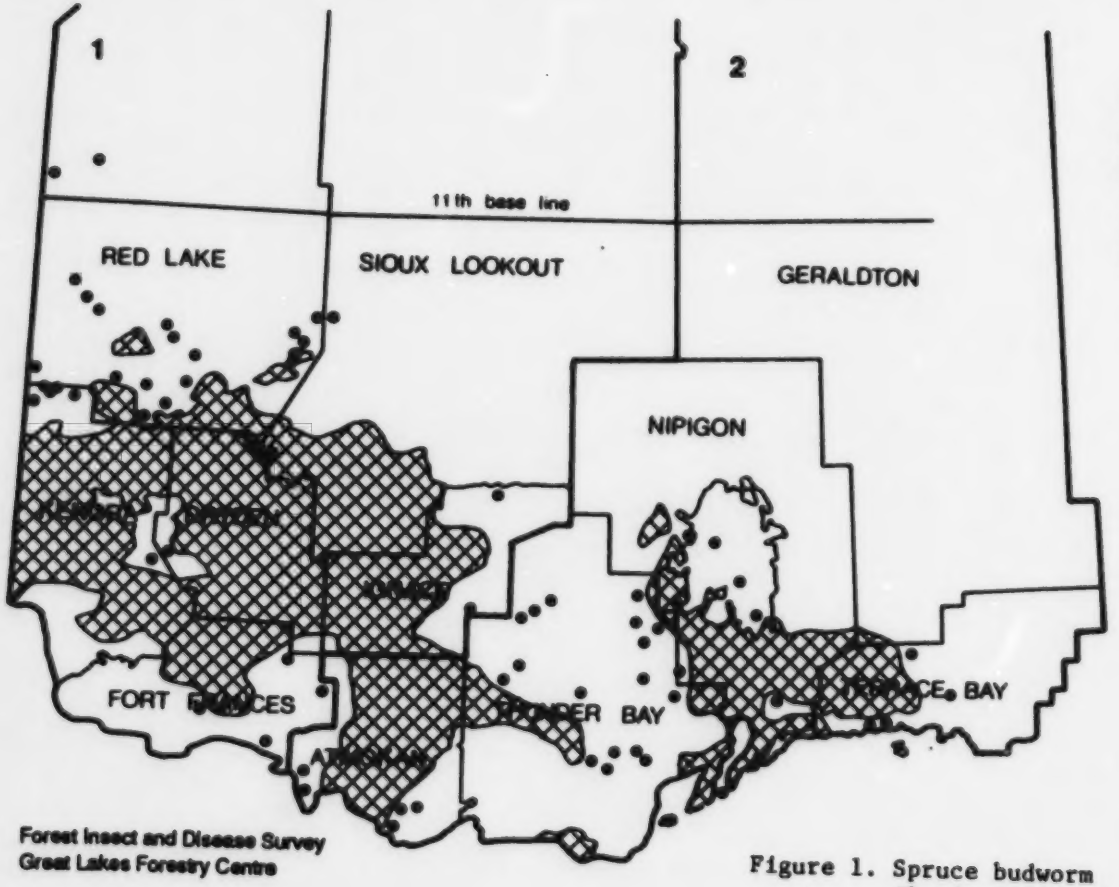

Figure 1. Spruce budworm
Choristoneura fumiferana (Clem.)

Areas within which moderate-to-severe defoliation occurred in 1988

⊠ or •

parts of which were areas first infested in 1974 and in which whole-tree mortality of balsam fir has been recorded since 1977. The area of collapse was bounded on the west by Watten Township, on the east by Bennett Township, on the south by Wild Potato Lake, and by Eltrut-Entwine lakes in the north. The largest area of population reduction in Ignace District occurred in the area surrounding the northern half of Sturgeon Lake and extending into Boucher Township. The slight decrease in the area infested in Sioux Lookout District and the slight increases in Dryden and Kenora districts can be attributed to the fluctuating nature of populations along infestation borders. The 10,194-ha increase in Red Lake District resulted in part from the appearance of new satellite pockets of defoliation. These pockets occurred north of the large, continuous bodies of damage in susceptible host stands around lake shores, such as in the Murdock-Musclow lakes area and the Birch-Uchi lakes area (Fig. 2).

Table 1. Gross area of moderate-to-severe defoliation (ha) by spruce budworm in the Northwestern Region of Ontario from 1984 to 1988.

	Area of moderate-to-severe defoliation (ha)				
District	1984	1985	1986	1987	1988
Dryden	454,099	952,385	891,997	835,308	907,685
Fort Frances	566,831	700,172	542,176	497,579	275,817
Ignace	456,526	599,895	530,761	584,322	512,961
Kenora	63,314	911,037	906,917	821,074	886,627
Red Lake	200	10	200,349	256,167	266,361
Sioux Lookout	126,831	240,048	428,830	556,457	540,334
Total	1,667,801	3,403,547	3,501,030	3,550,907	3,389,785

Aerial surveys revealed that 40% of the area mapped in the moderate-to-severe infestation category experienced moderate defoliation (<75% current defoliation) (Table 2). A large part of this damage occurred in Sioux Lookout District and the northern part of Ignace District and was typified by extremely variable defoliation. Ground checks of balsam fir in these areas disclosed individual tree defoliation ranging from 20 to 80%. Overall stand defoliation of balsam fir ranged from 35 to 65%. This area of sporadic budworm defoliation coincides closely with the area adversely affected by frost in 1987, when moderate-to-severe foliar damage to white spruce and balsam fir was recorded. The nature of the 1987 frost damage was described as variable and this, combined with the reported light mortality of budworm larvae, may have influenced the 1988 pattern of defoliation in the Sioux Lookout and Ignace districts. Areas of moderate infestation in the other districts were characterized by more uniform defoliation.

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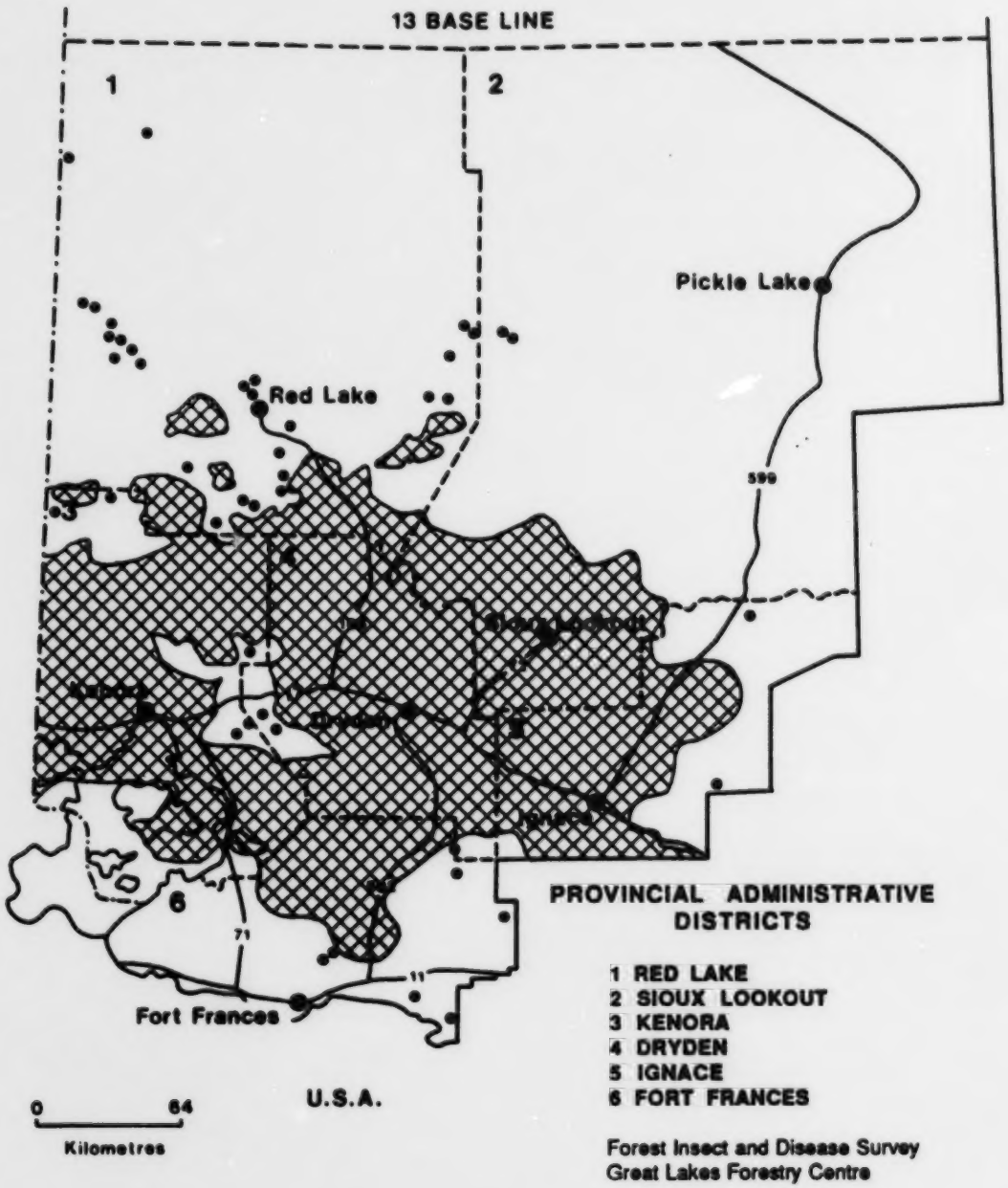

Figure 2. Spruce budworm
Choristoneura fumiferana (Clem.)

Areas within which moderate-to-severe defoliation occurred in 1988

▨ or •

Table 2. Area of defoliation (ha) by spruce budworm in the Northwestern Region of Ontario in 1988.

District	Defoliation class: Severe (>75%)	Defoliation class: Moderate (25-75%)
Dryden	600,330	307,355
Fort Frances	844	274,973
Ignace	315,834	197,127
Kenora	837,587	49,040
Red Lake	263,545	2,816
Sioux Lookout	26,522	513,812
Total	2,044,662	1,345,123

Egg-mass sampling was carried out at 140 locations across the region, 125 of which were sampled in the previous year as well. Interpretation of the results, gathered from locations common to both years, indicates an overall reduction of 24% in the average egg-mass density per 9.29 m^2 of foliage (Table 3). Examination of the egg-mass results on a district basis revealed that increased egg-mass densities were recorded in the Dryden and Sioux Lookout districts, whereas egg-mass densities remained constant in Red Lake District. Although an overall decline in egg-mass densities occurred, moderate, moderate-to-severe and severe defoliation is forecast at 84% of the locations sampled (cf. Appendix, Table A1).

Table 3. Comparison of spruce budworm egg-mass densities in the Northwestern Region of Ontario in 1987 and 1988.

District	No. of locations	No. of locations with increase	Average egg-mass density per 9.29 m^2: 1987	Average egg-mass density per 9.29 m^2: 1988	% change
Dryden	21	9	394.5	410.8	+4
Fort Frances	20	1	229.4	120.8	-60
Ignace	18	8	345.8	263.2	-24
Kenora	26	7	669.0	326.1	-51
Red Lake	18	10	334.5	334.3	0
Sioux Lookout	22	13	227.2	312.8	+38
Overall	125	48	391.3	297.3	-24

Moderate-to-severe defoliation is expected to occur within the areas currently infested except in the older areas of infestation in the central part of Fort Frances District, in which population decreases will continue to occur. Additional pockets of moderate-to-severe damage will continue to appear around lake shores north of the main body of infestation.

In conjunction with the regular egg-mass sampling, groups of three pheromone traps were deployed at 12 locations across the region. These traps are part of a nationwide program to develop a relatively inexpensive and efficient tool for monitoring spruce budworm populations. The plastic, non-saturating traps are equipped with a synthetic pheromone lure and a strip impregnated with a killing agent. The traps are set in place before the adult flight period, and are removed in the fall so the contents can be counted. The results of the 1988 trapping program reflect the trend indicated by the conventional system of egg-mass sampling, i.e., that there were fewer adults in 1988 than in 1987. The number of adults trapped in the region averaged 338 per location in 1987 and 142 in 1988.

Whole-tree mortality of balsam fir can occur after three to five years of moderate-to-severe defoliation. Balsam fir tree mortality was first reported in the region in 1977 in a 405-ha area of Fort Frances District after three years of moderate-to-severe defoliation. Since then, the area of budworm-associated tree mortality in the region has increased considerably (Fig. 3). A 197,404-ha increase was recorded in 1988, which brought the total area within which whole- or partial-tree mortality was mapped to 486,012 ha. The bulk of this increase occurred in the Fort Frances, Dryden and Ignace districts (Table 4). Spruce budworm-killed trees were reported for the first time in Sioux Lookout District, in the Kukukus and Amik lakes area, and the northernmost pockets of dead balsam fir were observed in the Portal-Marshalok lakes area of Dryden District.

Table 4. Increases in the area of spruce budworm-related balsam fir tree mortality in the Northwestern Region of Ontario in 1988.

District	Mortality increase in 1988 (ha)
Dryden	22,606
Fort Frances	87,395
Ignace	86,833
Kenora	450
Sioux Lookout	120
Total	197,404

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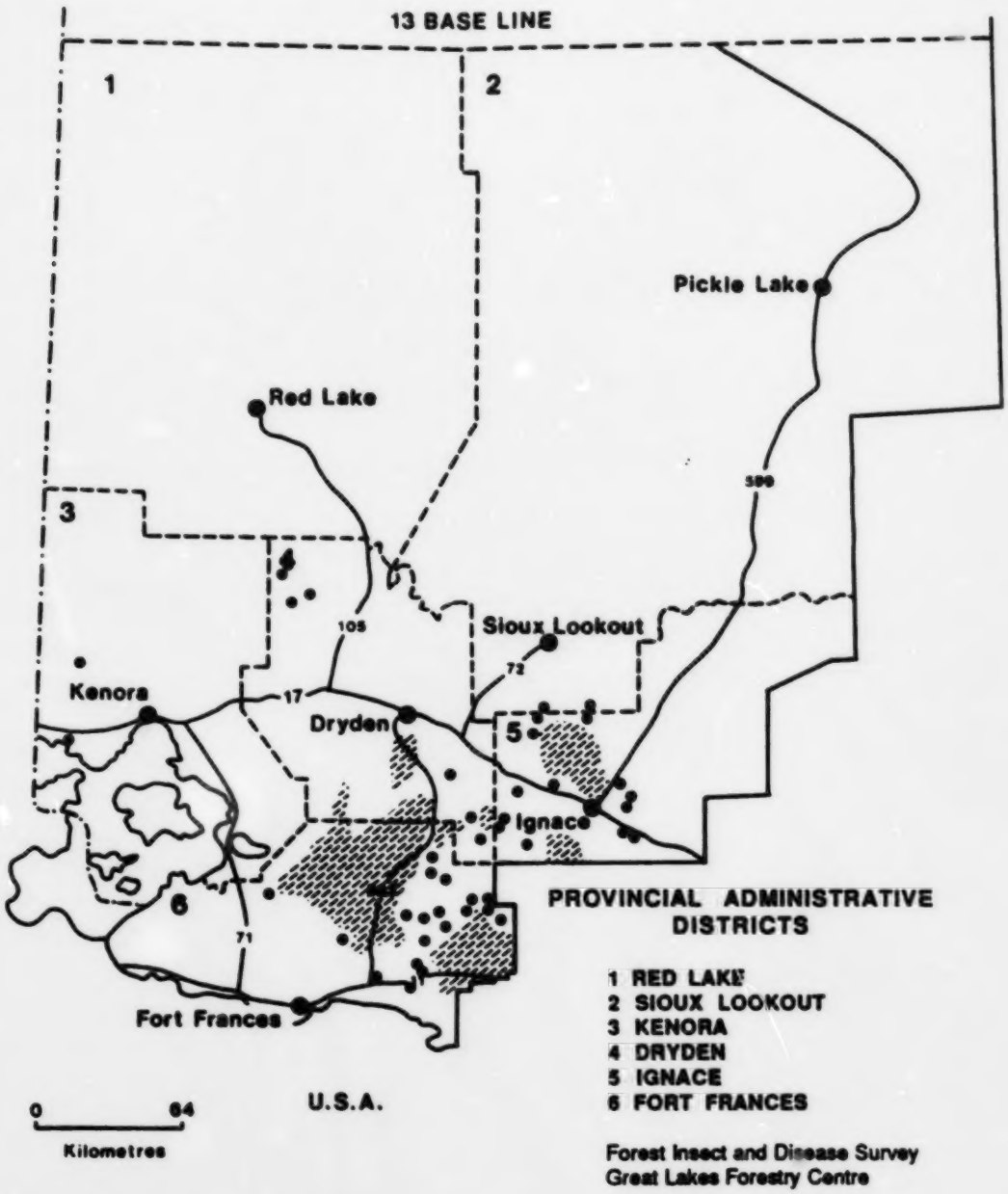

Figure 3. Spruce budworm
Choristoneura fumiferana (Clem.)

Areas within which whole-tree and top mortality of balsam fir occurred in 1988

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Ground checks to determine the incidence of balsam fir whole-tree mortality were conducted at 12 locations, some of which have been checked for a number of years (Table 5). Mortality ranged from 6% (moderate-to-severe defoliation for four consecutive years) near Portal Lake, Dryden District, to 96% in the Manitou Stretch area, Fort Frances District (11% mortality recorded at this location in 1982). The average mortality at plots surveyed in both 1987 and 1988 increased over all from 48% in 1987 to 57% in 1988.

Table 5. Summary of spruce budworm-associated mortality of balsam fir based on ground checks for a five-year period in the Northwestern Region of Ontario.

	Tree mortality (%)				
Location	1984	1985	1986	1987	1988
Dryden District					
Ingall Lk	2	6	6	10	13
Minnehaha Lk	-	8	13	31	33
Portal Lk	-	-	-	-	6
Fort Frances District					
Eltrut Lk	61	48	88	96	-[a]
Harris Lk	42	27	49	55	66
Kawawia Creek	-	25	25	79	82
Manitou Stretch	24	55	76	79	96
Strong Lk	31	15	52	59	71
Ignace District					
Abamategwia Lk	-	-	-	-	51
Dimple Lk	-	-	8	25	41
Pluto Lk	-	-	-	-	17
Kenora District					
Forgie Twp	-	-	-	-	37

[a] no longer sufficient living hosts

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Provincial Situation

The Northwestern Region was not the only area that hosted high population levels of jack pine budworm in 1988. A small infestation of

approximately 600 ha was recorded in the English River area of Thunder Bay District, North Central Region. This situation is interesting because the most recent infestation of jack pine budworm in the North Central Region collapsed in 1986. As well, this infestation has significance for the Northwestern Region because of its proximity.

Northwestern Region

The Northwestern Region weathered another attack by the jack pine budworm; 1988 was the fifth consecutive year of medium-to-heavy infestation.

Surveys in 1988 disclosed 736,882 ha of jack pine (**Pinus banksiana** Lamb.) forests that experienced moderate-to-severe defoliation, a 232,133-ha increase (46%) over the previous year but a 817,257-ha decrease from the peak infestation in 1986 (Fig. 4).

The current pattern and intensity of infestation was not what had been forecast for 1988. On the basis of historical information, the results of the 1987 egg-mass survey and the trend of increased insect parasitism and disease associated with an aging infestation, a collapse was predicted for most of the region, with some pockets of light-to-moderate defoliation in the Trout-Nungesser lakes area. A collapse did occur in areas of previous infestation in the southern part of the region but the area and intensity of damage in the Trout-Nungesser lakes area and other areas was greater than anticipated.

Several factors may have influenced the situation encountered in 1988. The warm, dry summer and the occurrence of localized areas of medium-to-heavy production of male flowers presented ideal conditions for enhancement of larval survival. Furthermore, the areas currently infested in 1988 north of the 11th baseline in Red Lake District were difficult to forecast reliably because only one egg-mass sample was taken from this area.

The entire area of moderate-to-severe defoliation occurred in the Red Lake and Sioux Lookout districts, between the 7th and 13th baselines (Fig. 5).

In Red Lake District, 489,103 ha of medium-to-heavy infestations were recorded. Damage was mapped north of McKenzie Bay, from Lac Seul to the 13th baseline, and west from the Sioux Lookout-Red Lake border to a line running north and south of Pikangikum Lake. A more detailed analysis shows considerable expansion in the infestation centered in the Trout-Nungesser lakes area, with moderate-to-severe defoliation occurring in one continuous body from the north end of Trout Lake to the McInnes-Frame lakes area. A number of new pockets of moderate-to-severe damage were mapped in the Madden-MacDowell-Margot lakes area. The Trout Lake ridge (on the west side of Trout Lake) continued to be infested by high population levels and moderate-to-severe defoliation recurred along the Sioux Lookout-Red Lake district boundary in the Celt-Aerofoil lakes

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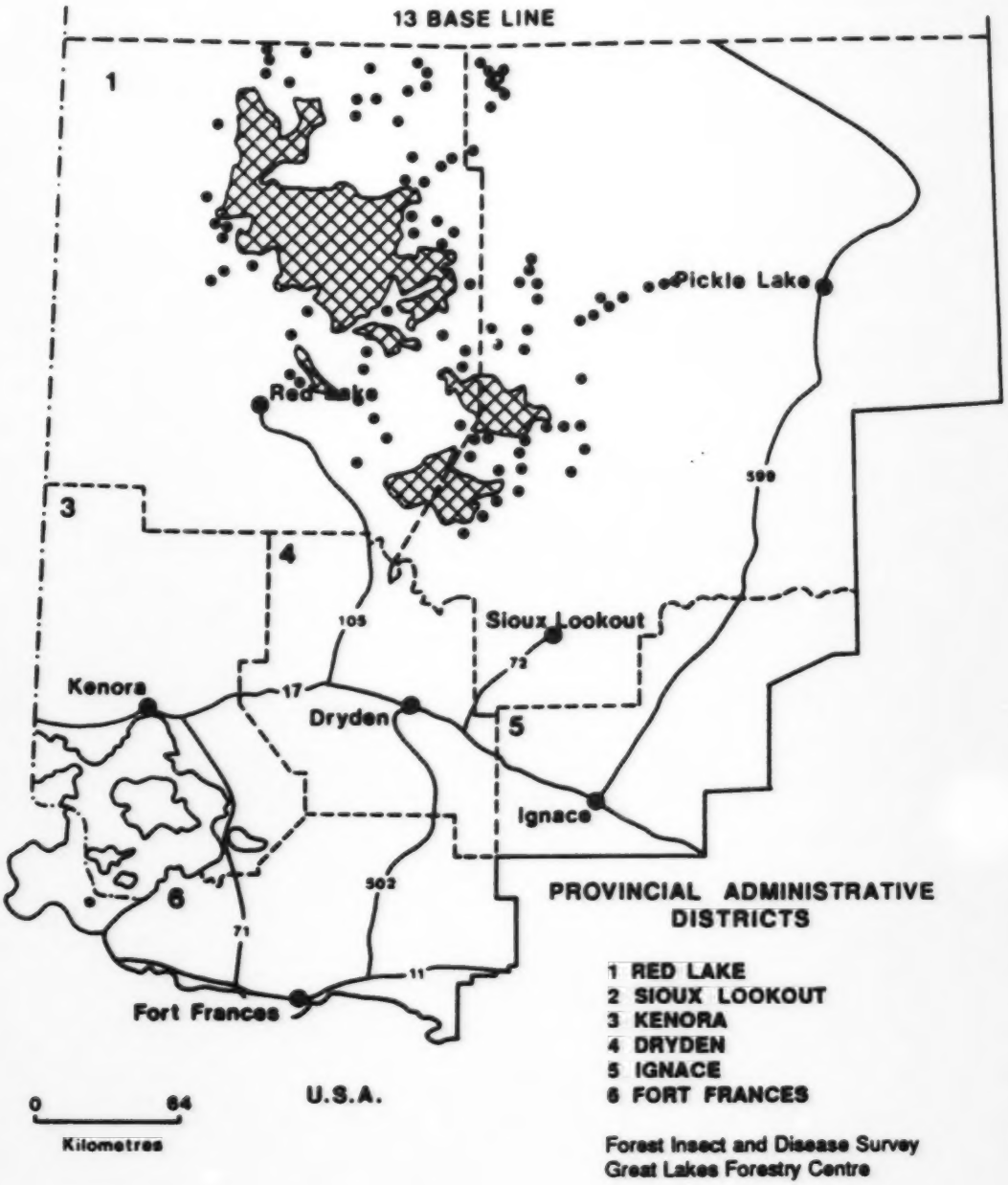

Figure 4. Jack pine budworm
Choristoneura pinus pinus Free.

Areas within which moderate-to-severe defoliation occurred in 1988
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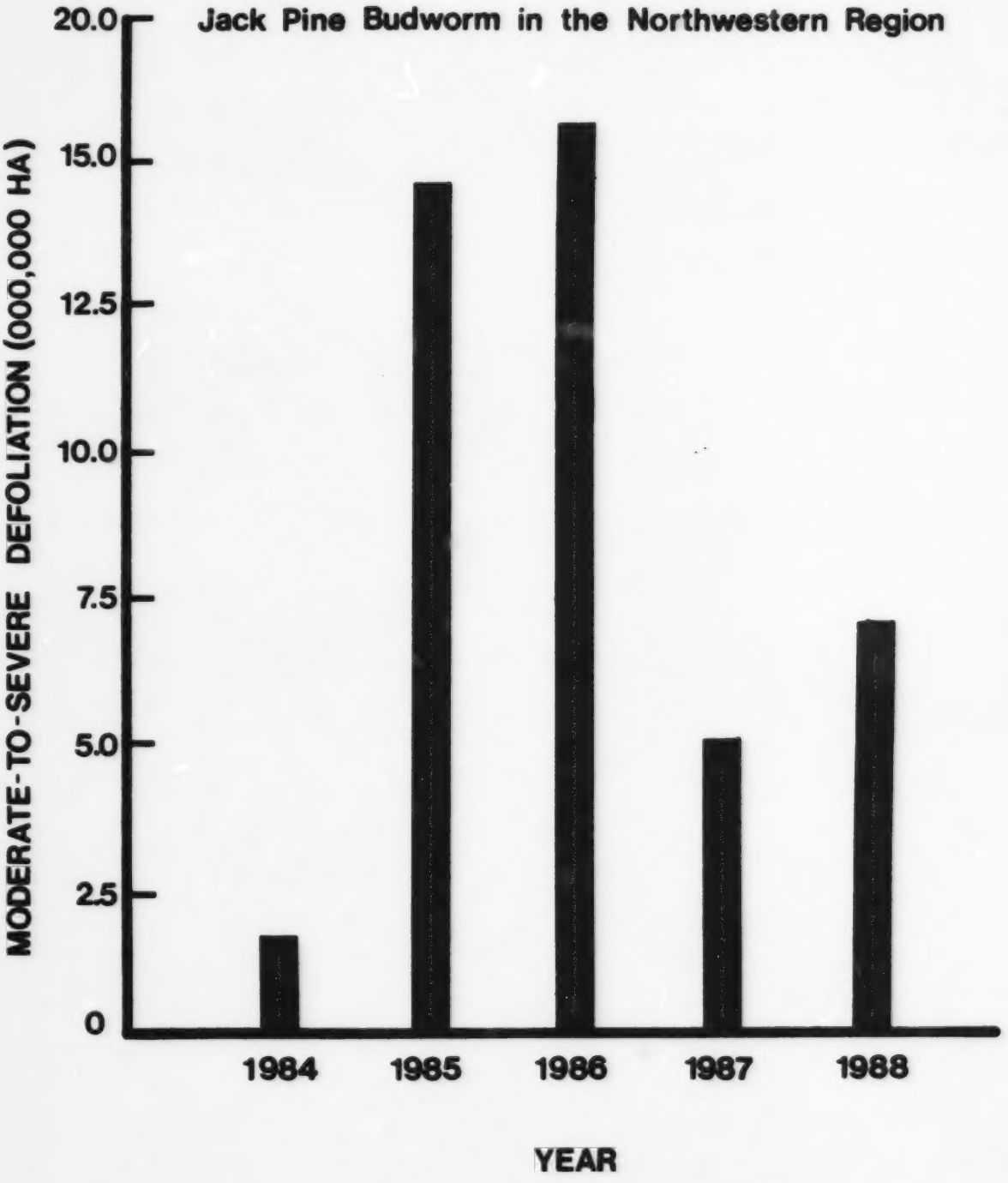

Figure 5. Area of damage caused by the jack pine budworm (*Choristoneura pinus pinus* Free.) over a 5-year period in the Northwestern Region of Ontario.

area. A new area of infestation that was also shared with Sioux Lookout District occurred in the Jubilee-Perrigo-Papaonga lakes area.

The largest areas of medium-to-heavy infestation in Sioux Lookout District were those previously mentioned that occurred along the district border shared with Red Lake District. A smaller area of moderate-to-severe defoliation was recorded in the Gull-Deaddog lakes area and isolated pockets of similar damage were noted as far north as the 13th baseline. In all, about 60 small pockets of medium infestation were observed.

Of the area mapped as moderately-to-severely defoliated, the bulk of the defoliation (551,770 ha) was considered moderate (25-75% current defoliation); many stands could have experienced only 30% current defoliation. This would have resulted in reduced stress on affected trees in comparison with those that experienced severe defoliation (Table 6).

Table 6. Areas defoliated (ha) by jack pine budworm in the Northwestern Region of Ontario in 1988.

	Defoliation (ha)	
District	Severe (>75%)	Moderate (25-75%)
Red Lake	123,993	489,103
Sioux Lookout	61,119	62,667
Total	185,112	551,770

Strictly on the basis of results of the 1988 egg-mass sampling program, which excludes such variables as increased levels of parasitism and disease associated with an aging infestation, weather irregularities or male flower production on jack pine, it would appear that areas of moderate-to-severe defoliation can be forecast to occur throughout the area infested in 1988 (Fig. 6). A total of 98 locations was sampled for egg masses throughout the Northwestern Region (see Appendix, Table A2). The egg-mass survey results disclosed high counts at 24 locations, all in the Red Lake and Sioux Lookout districts, which, under ideal conditions, translates into increased numbers of larvae (Table 7).

The stress caused by moderate-to-severe defoliation results in growth loss, bare upper crowns and whole-tree mortality. Approximately 18,000 ha of whole-tree mortality and bare tops were mapped within a 255,000-ha area in Red Lake District (Fig. 7). The affected area was bounded in the south by the Vermilion-Coli-Trout lakes area, by the Silcox-Berens lakes area in the north, by the Kirkness-Reigate lakes area in the west, and by the Nechigona-Pierson lakes area in the east.

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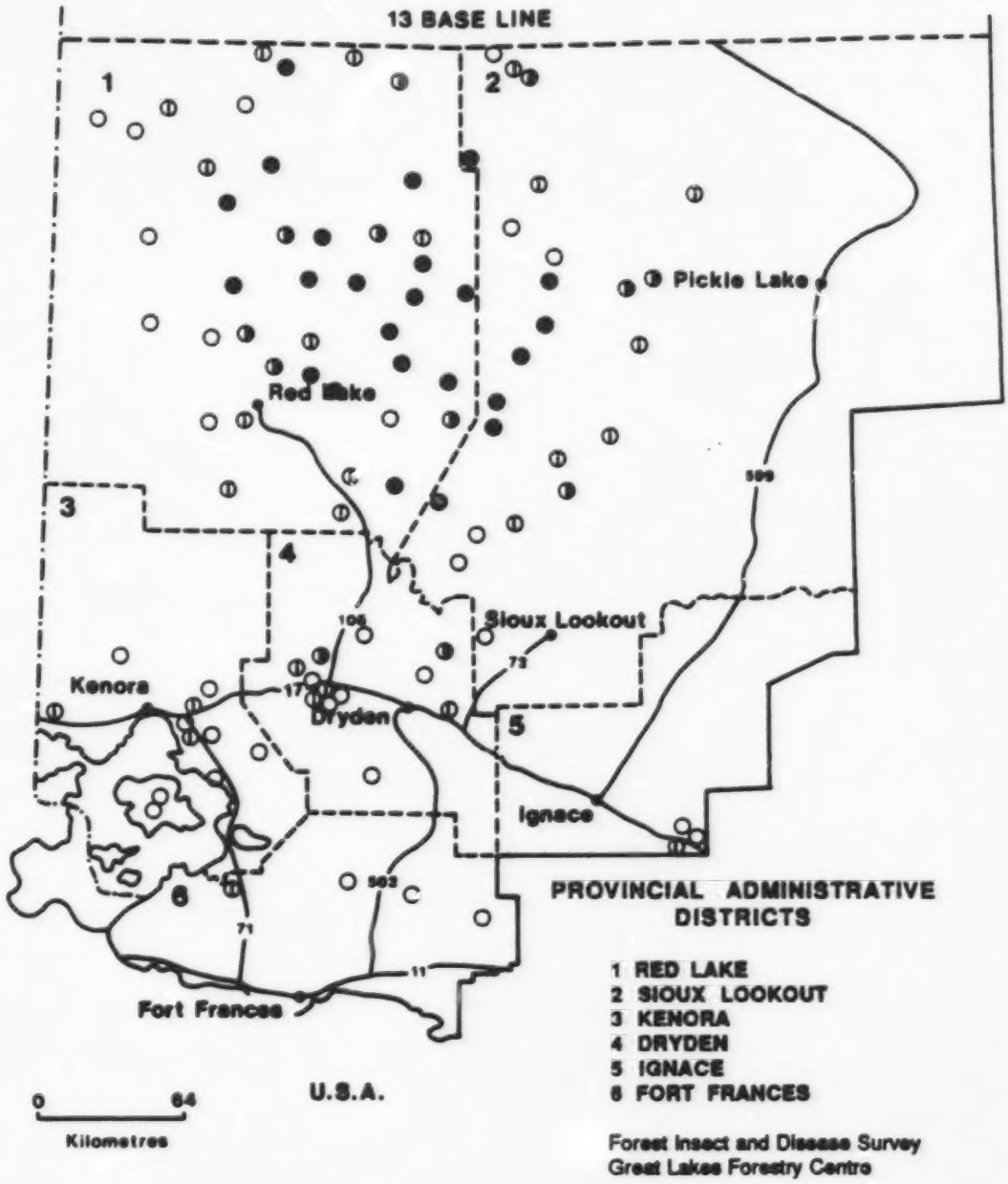

Figure 6. Jack pine budworm
Choristoneura pinus pinus Free.

Locations of egg-mass collections and defoliation forecasts for 1989

Severe ● Light ◑

Moderate ◑ Nil ○

Three 100-tree plots exist in representative areas of whole-tree mortality. One plot was established west of Pedlar Lake in 1987 and the other two were set up in the current year. The mortality plots are spread out so that one occurs in each of the northern, central and southern parts of the outlined area of trees damaged by jack pine budworm (Fig. 7). Whole-tree mortality in these plots ranged from 6 to 9% and accompanying bare or dead tops ranged from 2 to 21% (Table 8). The majority of dead jack pine trees were dominant or codominant.

Table 7. Comparison of jack pine budworm egg-mass densities in the Northwestern Region of Ontario in 1987 and 1988.

District	No. of locations common to 1987 and 1988	Average egg-mass density per plot		% change
		1987	1988	
Dryden	11	4.3	0.8	-81
Fort Frances	3	2.3	0.3	-86
Ignace	1	3.0	0.0	-100
Kenora	12	1.6	0.2	-84
Red Lake	15	5.0	6.4	+28
Sioux Lookout	7	2.6	6.0	+133
Over all	49	3.5	3.1	-11

Table 8. Summary of tree mortality associated with jack pine budworm on the basis of the examination of 100 jack pine trees at each location.

Location	Number of trees					
	Bare tops		Living		Dead	
	1987	1988	1987	1988	1987	1988
Kenora District						
Norway Lk	9	9	80	76	11	15
Red Lake District						
Baird Twp	4	3	78	78	18	19
Berens Lk, S. Arm (south of)	-	21	-	70	-	9
Pedlar Lk (west of)	11	11	85	83	4	6
Phillips Lk	-	2	-	92	-	6

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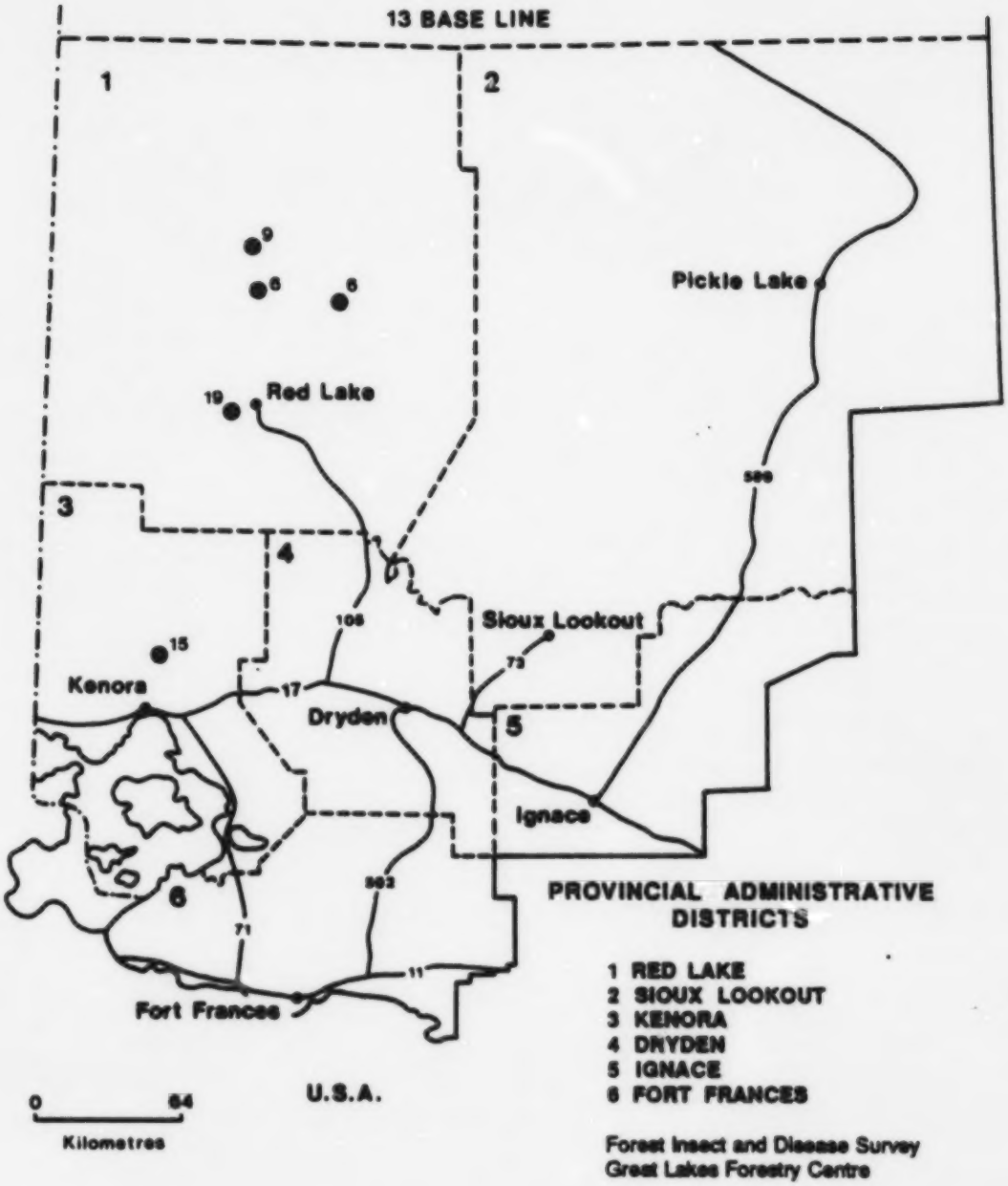

Figure 7. Jack pine budworm
Choristoneura pinus pinus Free.

Locations of mortality plots and percentage of trees affected ●6

Plots established in 1986 at Norway Lake, Kenora District, and in Baird Township, Red Lake District, were reassessed; neither plot had experienced defoliation for two years and crown damage had stabilized, but a slight increase in mortality was recorded.

Greenstriped Mapleworm, **Dryocampa rubicunda** (F.)

Population increases of this pest of red maple (**Acer rubrum** L.) were recorded in Fort Frances District for the second consecutive year. Historically, in this district, infestations have occurred in Watten and Halkirk townships, in the Mine Centre area and in the town of Fort Frances. In 1988, defoliation of understory and forest-edge trees was recorded from Oliver Creek on Highway 502, south and west of Reef Point Road, Watten Twp, and east along Highway 11 to the Barber Lake area. The heaviest damage occurred at Oliver Creek, where a 50-tree assessment of 6.0-m-tall trees revealed that the entire sample was attacked and defoliation averaged 60%. Elsewhere, defoliation ranging from 15 to 30% was observed in most infested areas.

Eastern Pine Shoot Borer, **Eucosma gloriola** Heinr.

Population increases of this shoot-boring pest were observed in jack pine regeneration across the region. The eastern pine shoot borer attacks the current, lateral and terminal shoots of jack pine. High population levels can affect growth and attack on the terminal shoot causes undamaged laterals to vie for dominance, which results in a tree with poor form. Unlike white pine weevil (**Pissodes strobi** [Peck]), the eastern pine shoot borer destroys only one year's growth.

In 1987 the pest was detected in survey plots in only 2 of 14 areas of jack pine regeneration examined; in 1988 the shoot borer was found on the survey plots at all 16 locations evaluated. Visits in 1988 to the two areas in which surveys detected the pest in 1987 also reflected population increases (Table 9). Levels of attack on terminal shoots of 0.7% and 1.3% in 1987 increased to 4.7% and 5.3% near Goodie Lake, Sioux Lookout District and Furniss Township, Ignace District, respectively.

Terminal shoot damage in the current survey ranged from 0.7 to 5.3% and averaged 2.5% over all. Similar population levels were last reported in 1982.

Table 9. Summary of damage caused by the eastern pine shoot borer at 16 locations in the Northwestern Region of Ontario in 1988 and a comparison of leader damage at locations surveyed in 1987 and 1988 (counts based on the examination of 150 or 250 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees with laterals attacked (%)	Leaders attacked (%)	
					1987	1988
Dryden District						
Aubrey Twp[a]	3.4	1,973	150	0.8	-	3.7
Satterly Twp	1.5	3,333	10	0.0	-	4.7
Zealand Twp	2.3	2,990	5	0.0	-	1.3
Fort Frances District						
Otter Falls	2.5	4,630	150	0.0	-	1.3
Turtle Station	3.6	3,125	25	0.0	-	1.3
Ignace District						
Furniss Twp	1.6	5,680	50	0.7	1.3	5.3
Furniss Twp[a]	3.8	7,500	876	1.6	-	3.2
Kenora District						
Broderick Twp[a]	3.6	8,333	3,600	0.0	-	1.6
MacNicol Twp	1.8	8,500	500	0.0	0.0	0.7

(cont'd)

Table 9. Summary of damage caused by the eastern pine shoot borer at 16 locations in the Northwestern Region of Ontario in 1988 and a comparison of leader damage at locations surveyed in 1987 and 1988 (counts based on the examination of 150 or 250 randomly selected jack pine trees at each location) (concl.)

Location	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees with laterals attacked (%)	Leaders attacked (%)	
					1987	1988
Red Lake District						
Dixie Lk Rd (km 10)	2.1	2,600	30	0.0	0.0	1.3
Goose Bay, Hwy 105	1.6	9,600	100	0.7	-	1.3
Wenasaga Lk Rd	3.0	2,800	100	1.3	0.0	2.0
Sioux Lookout District						
Dominion Lk Rd	3.1	8,300	100	0.0	0.0	3.3
Goodie Lk	1.7	3,425	25	0.0	0.7	4.7
Stanzhikimi Lk Rd	1.5	3,730	20	0.0	0.0	2.7
Vermilion River Rd[a]	4.6	2,490	100	5.3	-	1.3

[a] 250-tree sample

Forest Tent Caterpillar, **Malacosoma disstria** Hbn.

Stands of trembling aspen (**Populus tremuloides** Michx.) in the Northwestern Region hosted large populations of the forest tent caterpillar for the second consecutive year. The current situation is somewhat different from the one observed in 1987, when the infestation was composed of 32 small pockets totaling 5,500 ha in Fort Frances District. Aerial surveys in 1988 disclosed that the area of medium-to-heavy infestation had increased to 272,985 ha, with associated defoliation ranging from 45 to 90% and no longer confined to Fort Frances District (Fig. 8).

The largest area of moderate-to-severe defoliation was recorded in Fort Frances District, covering 257,305 ha of forested land. The bulk of the defoliated aspen occurred in three large pockets across the district west from the Atikokan District boundary to Lake of the Woods. A number of smaller pockets of medium-to-heavy infestation were mapped along the Canada-United States border.

Twelve pockets of moderate-to-severe damage that covered approximately 15,070 ha were recorded in Kenora District. Defoliation occurred in the area of Highway 71 from Nestor Falls to Sioux Narrows, in the Pipestone and Rowan lakes area, south of Rat Portage Bay, Lake of the Woods, and on the eastern and western shores of Shoal Lake.

Surveys disclosed 610 ha of moderate-to-severe defoliation in four small pockets in Dryden District. Stands of trembling aspen at two locations on Highway 17 in Southworth Township, as well as stands of host trees on the eastern and western shores of Dore Lake, were infested with large populations of this pest.

Light defoliation of ornamentals was reported in the towns of Dryden, Fort Frances, Kenora, Ignace, Red Lake and Sioux Lookout.

Egg-band counts for the purpose of forecasting 1989 infestation levels were conducted at 23 locations (Fig. 9). This information is summarized in Table 10. From the results, it appears that moderate-to--severe defoliation will occur at 75% of the areas sampled. The large, separate bodies of damage in Fort Frances District may merge and the present infestation in the Kenora and Dryden districts can be expected to expand.

Sawyer Beetles, **Monochamus** spp.

Characteristic red flagging of branches and associated whole-tree mortality of merchantable jack pine were observed at four locations in the region. Less than 5 ha of recent whole-tree mortality, confined to fringe trees of surviving stands, was recorded at each site.

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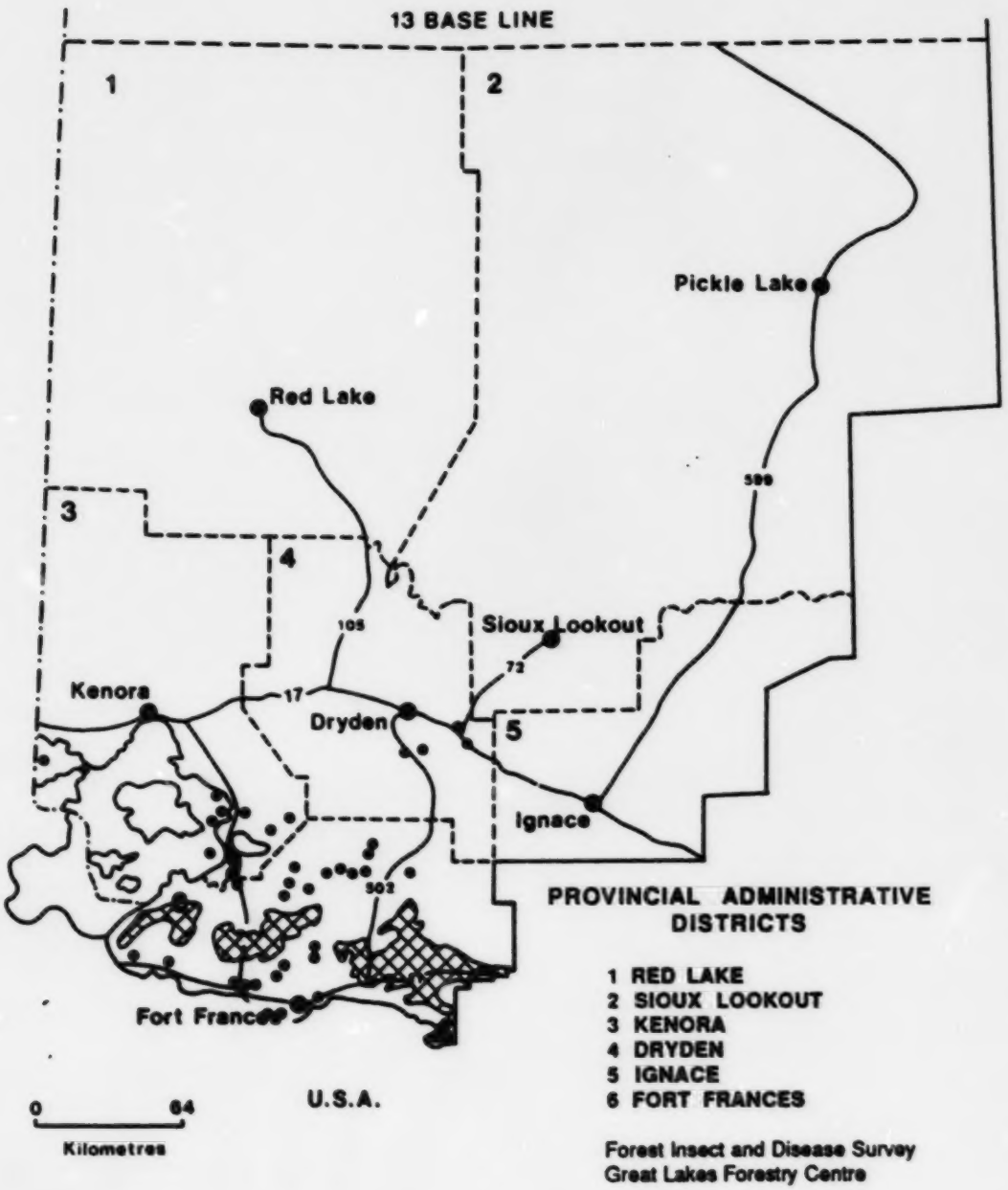

Figure 8. Forest tent caterpillar
Malacosoma disstria Hbn.

Areas within which moderate-to-severe defoliation occurred in 1988

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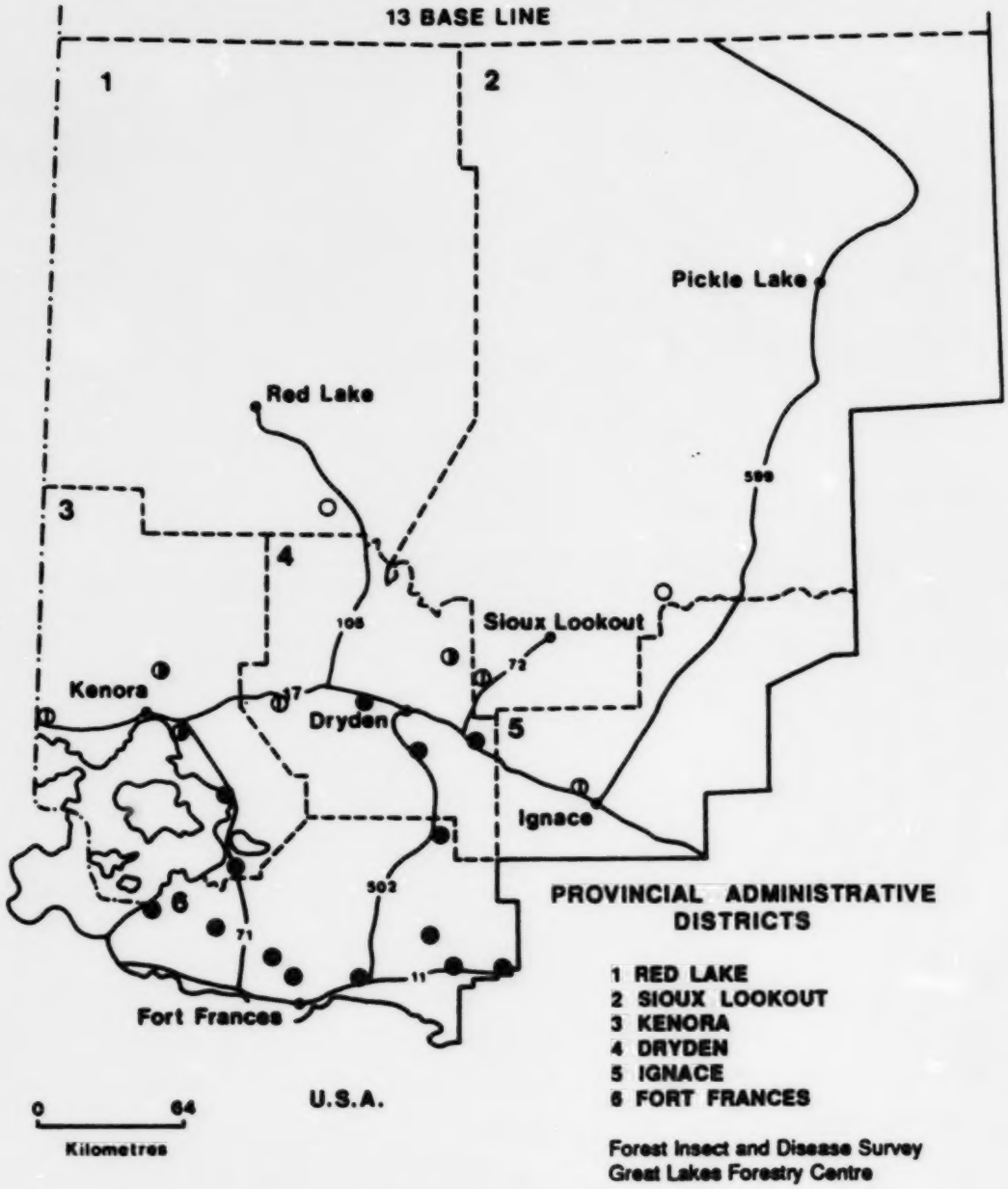

Figure 9. Forest tent caterpillar
Malacosoma disstria Hbn.

Location of egg-band counts and defoliation forecasts for 1989

Severe ● Light ◐

Moderate ◑ Nil ○

Table 10. Summary of forest tent caterpillar egg-band counts at 23 locations in the Northwestern Region of Ontario in 1988 and infestation forecasts for 1989.

Location	Avg. DBH of sample trees (cm)	No. of trees sampled	Total no. of egg bands	Infestation forecast for 1989
Dryden District				
Breithaupt Twp	10.5	3	6	Moderate
Bridges Twp	15.2	3	1	Light
Godson Lk	16.0	1	23	Severe
Sandford Twp	10.5	1	19	Severe
Southworth Twp	14.0	1	80	Severe
Fort Frances District				
Miscampbell Twp	13.2	1	28	Severe
Dance Twp	9.1	1	11	Severe
McCrosson Twp	16.1	1	13	Severe
Otter Rapids	25.0	1	15	Severe
Richardson Twp	18.2	1	187	Severe
Scattergood Lk	31.0	1	29	Severe
Seine River	11.0	1	58	Severe
Turtle Station	14.0	1	56	Severe
Watten Twp	9.0	1	85	Severe
Ignace District				
Bradshaw Twp	13.4	3	1	Light
Kenora District				
Ewart Twp	10.1	3	1	Light
Godson Twp	12.2	1	26	Severe
Kirkup Twp	10.8	3	5	Moderate
Redditt Twp	11.9	3	5	Moderate
Willingdon Twp	11.5	1	112	Severe
Red Lake District				
Hwy 804	11.3	3	0	Nil
Sioux Lookout District				
Echo Twp	11.2	3	1	Light
Hwy 516	11.1	3	0	Nil

Recent branch and whole-tree mortality was noted at two areas in McNevin Township, Ignace District. Trees in the vicinity of the log piles at the Martin siding as well as fringe trees at the nearby Canadian Pacific Forest Products camp were attacked by large populations of adult beetles. Severely damaged trees were also detected along the edge of recent cutovers south of Dixie Lake, Red Lake District, and in the vicinity of Coones Bay, Lac Seul, Sioux Lookout District.

Observation also disclosed branch and whole-tree mortality on 3-m-tall roadside jack pine growing near a log pile on the Deer Lake Road, Dryden District. Assessment showed 60% branch mortality on trees within 40 m of the log pile for a distance of 0.7 km along the road.

Pine Sawflies: Pine Sawfly, **Neodiprion maurus** Roh.
Red Pine Sawfly, **N. nanulus nanulus** Schedl.,
Jack Pine Sawfly, **N. pratti banksianae** Roh.,
Swaine Jack Pine Sawfly, **N. swainei** Midd.,
Redheaded Jack Pine Sawfly, **N. virginiana** complex

Populations of these sawflies of jack pine and red pine (**Pinus resinosa** Ait.) were low and associated defoliation was variable, depending on tree size; severe defoliation was recorded on some small trees. Collectively, these five sawflies were widespread.

Defoliation of jack pine by **N. maurus** was recorded at five locations in the region. The pest was observed attacking occasional open-growing 1-m-tall trees in the Morson black spruce seed orchard, Fort Frances District and 15-m-tall, open-growing trees in Drayton Township, Sioux Lookout District. Assessments were carried out at three other locations and the results are as follows: 4% of 2-m-tall jack pine near Moss Lake, Ignace District, experienced 10% defoliation; 1.3% of 3-m-tall trees in a 0.25-ha area in Corman Township, Ignace District, were attacked and associated defoliation was 5%; 12% of 1.2-m-tall trees along Highway 11, near the Seine River, Fort Frances District, experienced 80% defoliation.

The red pine sawfly, **N. nanulus nanulus**, was the most commonly collected sawfly in 1988, but in most cases only single jack pine and red pine ranging in height from 1.0 to 5.0 m were affected. Assessment disclosed two exceptions, in which a number of 3-m-tall, roadside jack pine in Smellie Township, Dryden District and Dewan Township, Ignace District, experienced 5% defoliation.

Jack pine was observed hosting low populations of **N. pratti banksianae** at several locations. Evaluations revealed that 1.2% of 4.6-m-tall trees on the Vermilion River Road, Sioux Lookout District, 0.7% of 3.8-m-tall trees in Furniss Township, Ignace District, and 0.4% of 3.4-m-tall trees in Aubrey Township, Dryden District, were attacked with defoliation averaging less than 10% at each location. Elsewhere, single-tree attacks were recorded in Claxton and Rowe townships, Fort Frances District.

Historically, **N. swainei** has been responsible for severe defoliation of shoreline trees on Rainy Lake, Fort Frances District. However, only small numbers were recovered from trees on Sandpoint Island in Rainy Lake in 1988. A single colony was collected from a 1-m-tall shoreline jack pine on Abram Lake, Sioux Lookout District.

Aspen Leafblotch Miner, **Phyllonorycter ontario** (Free.)

The highest population levels and accompanying severe leaf browning of trembling aspen existed in the southern part of the region, with Highway 17 serving as a boundary of sorts between light and heavy infestations.

Damage encountered in stands of aspen along Highway 17, most notably from west of the town of Ignace to the town of Kenora, represents the most severe damage encountered in the region since 1983. Assessment of 20-m-tall fringe trees at one location along this corridor in Revell Township, Ignace District, revealed that 100% of the foliage up to the 15-m level was attacked, with an average of three mines per leaf. Examination of nearby 3-m-tall roadside trees revealed that the entire sample was attacked and 100% of the foliage was damaged, with an average of four mines per leaf (Table 11). Similar damage was observed in fringe stands surrounding lake shores and along roadways, railways, powerlines and gas pipelines south of Highway 17.

Table 11. Summary of aspen leafblotch miner damage on trembling aspen at locations in the Northwestern Region of Ontario in 1988.

Location	Avg ht of trees (m)	Trees affected (%)	Foliage affected (%)	Avg no. of mines per leaf
Fort Frances District				
Manion Lk Rd	5.0	100	100	4
Ignace District				
Revell Twp	3.0	100	100	4
Red Lake District				
Killala Twp	2.0	100	10	1
Wenasaga Lk Rd	2.0	28	1	1
Sioux Lookout District				
Echo Twp	1.5	100	40	2
Marchington Rd	3.0	100	5	1

Elsewhere, in northern stands, only low population levels were recorded. The incidence of attack ranged from 28 to 100% with accompanying foliar damage of 1 to 40% and only one or two mines per affected leaf.

White Pine Weevil, **Pissodes strobi** (Peck)

The results of surveys conducted in 1988 indicate substantial population decreases across the region; figures from the current surveys represent the lowest numbers recorded since 1982.

A total of 15 areas of jack pine regeneration, 3.5 m in height or less, were assessed in 1988. Weevils were encountered in plots at only six of these locations, which indicates very low population levels. As well, the highest incidence of leader attack in the current surveys was only 3.3% whereas in 1987 there were six areas in which the proportion of damaged leaders ranged from 10 to 20%.

The general collapse in populations is better illustrated by a comparison of nine areas evaluated in both 1987 and 1988 (Table 12). The incidence of damaged leaders in 1987 averaged 6.8% at these locations; this figure decreased to only 1.2% in 1988. The largest decrease was recorded in a 30-ha plantation on the Dixie Lake Road, Red Lake District, in which the number of infested leaders decreased from 20% in 1987 to 2.7% in 1988.

Mountain-ash Sawfly, **Pristiphora geniculata** (Htg.)

This introduced pest has actively extended its range since it was first recorded attacking ornamental mountain-ash (**Sorbus** spp.) in the town of Fort Frances in 1981. In 1988 it was observed attacking ornamental American mountain-ash (**Sorbus americana** Marsh.) in the town of Pickle Lake. The sawfly was also observed defoliating its natural host component throughout the forested areas between these two locations.

Surveys done in each of Ignace and Red Lake districts typify the variability of damage encountered in the region. Assessment in an area just north of Sandbar Provincial Park, Ignace District, revealed that 85% of the 2.0-m-tall trees were attacked and defoliation averaged 46%. A similar survey of 4.0-m-tall trees along a 20-km stretch of Highway 105 north of Ear Falls revealed that the entire sample was attacked and defoliation averaged 30%.

Early Aspen Leafcurler, **Pseudexentera oregonana** (Wlsm.)

Impact by this pest in stands of trembling aspen in 1987 was minimal, with the highest population levels recorded in host stands in the Longbow Lake area, Kenora district, where foliar damage averaged 25%.

Elsewhere in the region 5% foliar damage was commonly recorded. Population levels increased and the the areas affected expanded considerably in 1988. The previous infestation in Kenora District grew in size and five pockets totaling approximately 500 ha were reported. These occurred again in the Longbow Lake area and new pockets of moderate-to-severe damage occurred in Rice Township and along the Winnipeg River (Fig. 10). In the areas studied, foliar damage exceeded 75%.

Table 12. Summary of damage caused by the white pine weevil at 12 locations in the Northwestern Region of Ontario in 1988 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Leaders attacked (%)	
				1987	1988
Dryden District					
Rawlinson Lk	3.5	3,200	100	0.7	2.7
Satterly Twp	1.5	3,333	10	-	2.0
Fort Frances District					
Hillyer Creek	1.1	5,556	20	-	1.3
Otter Falls	2.5	4,630	150	18.0	3.3
Ignace District					
Furniss Twp	1.6	5,685	50	8.7	0[a]
Kenora District					
MacNicol Twp	1.8	8,500	500	0.0	0[a]
McMeekin Twp	2.9	4,546	25	2.0	0[a]
Red Lake District					
Coli Lk	1.4	2,000	50	-	0
Dixie Lk Rd	2.1	2,600	30	20.0	2.7
Hwy 105, Goose Bay	1.6	9,600	100	-	0[a]
McKenzie Bay Rd	3.0	2,800	100	10.0	2.0
Sioux Lookout District					
Dominion Lk Rd	3.1	8,300	100	1.3	0[a]
Goodie Lk	1.7	3,425	25	0.7	0[a]
Stanzhikimi Lk Rd	1.5	3,730	20	-	0[a]

[a] observed off assessment plots

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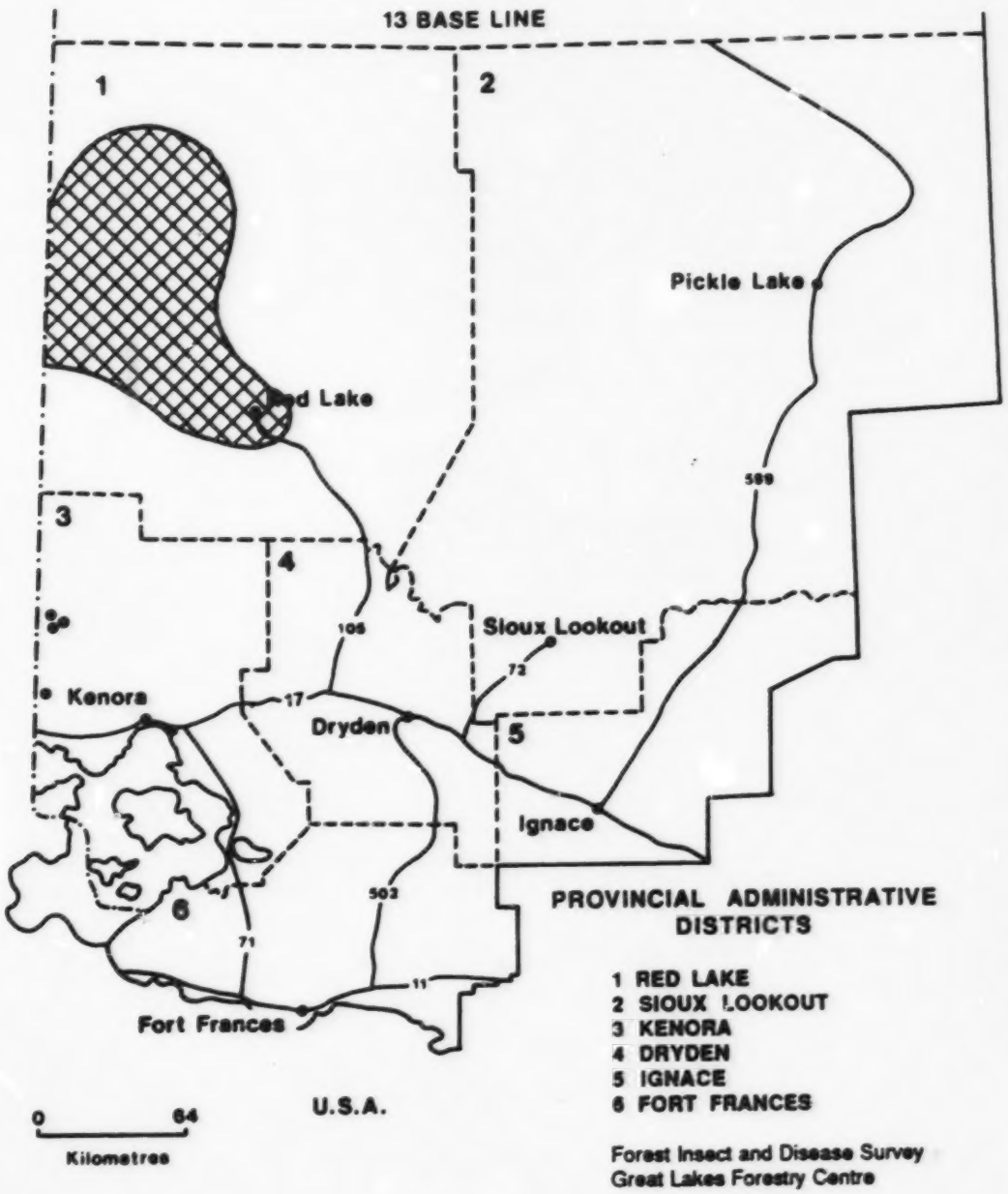


Figure 10. Early aspen leafcurler
Pseudexentera oregonana (Wlsm.)

Areas within which moderate-to-severe defoliation occurred in 1988
⊠ or •

The most extensive area of moderate-to-severe damage was mapped in a 10,000-km² (1,000,000-ha) area in the northwestern part of Red Lake District (Fig. 10). Shoreline trembling aspen supported the largest populations and ground checks revealed 100% foliar damage at these locations. Typical damage was not continuous within stands but was confined to "clumps" or groups of trees ranging in size from 5 to 250 ha. Average foliar damage within these stands was greater than 75%. The infested area also included the towns of Red Lake, Cochenour and Balmerton, and 100% damage to ornamental aspen was common.

Outside the areas of medium-to-heavy infestation, **P. oregonana** was observed in most stands of host trees causing up to 10% foliar damage. Also found in association with this pest at several locations were three other pests: the darkheaded aspen leafroller, **Anacampsis innocuella** (Zell.); the paleheaded aspen leafroller, **A. niveopulvella** (Chamb.); and the Bruce spanworm, **Operophtera bruceata** (Hlst.).

Minor Insects

Northern Pitch Twig Moth, **Petrova albicapitana** (Bsk.)

As described in earlier reports, the northern pitch twig moth feeds as a larva within a nodule of pitch, usually at an internode or fork of jack pine, and the resultant feeding damage extends almost to the pith (see photo page). Attack on the terminal whorl or the main stem can result in reduced growth; girdled or broken stems can also provide an entrance court for disease.

The pest was detected on plots at 5 of 16 locations surveyed, four of which had harbored detectable levels of the insect in 1987 (Table 13). A comparison of the two years indicates substantial population increases in three of the four areas, and an overall four-fold increase in the number of main-stem attacks. The most significant change was observed in a plantation of 1.4-m-tall trees near Coli Lake, Red Lake District, in which the rate of attack on terminal whorls or main stems increased from 2.0% in 1987 to 12.0% in 1988.

Table 13. Summary of damage by the northern pitch twig moth in the Northwestern Region of Ontario in 1987 and 1988 (counts based on the examination of 150 randomly selected jack pine regeneration trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area infested (ha)	Main stems attacked (%)	
				1987	1988
Ignace District					
Furniss Twp	1.6	5,680	50	0.7	0.7
Red Lake District					
Coli Lk	1.4	2,300	25	2.0	12.0
Dixie Lk Rd	2.1	2,600	30	1.3	4.7
Sioux Lookout District					
Goodie Lk	1.7	3,425	25	1.3	2.0
Stanzhikimi Lk Rd	0.7	3,730	20	-	0.7

Table 14. Other forest insects.

Insect	Host(s)	Remarks
Acantholyda sp. Webspinning sawfly		one web and accompanying light defoliation of a 3-m tree, Jordan Twp, Sioux Lookout District
Anoplonyx luteipes (Cress.) Threelined larch sawfly	tL	light defoliation detected on fringe trees, Cathcart Twp, Ignace District
Aphrophora cribrata (Wlk.) Pine spittlebug	jP	7% of 1.7-m trees near Goodie Lk, Sioux Lookout District, and 25% of 1.4-m and 1.6-m trees near Goose Bay, Lac Seul and Coli Lk, Red Lake District, respectively, were damaged, with one or two spittlemasses per tree

(cont'd)

Table 14. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Archips cerasivorana (Fitch) Uglynest caterpillar	chCh	Low numbers were observed at one location in Kingsford Twp, Fort Frances District.
Cephalcia fascipennis (Cress.) Spruce webspinning sawfly	wS	A single web was collected in Byshe Twp, Red Lake District.
Cephalcia spp. Webspinning sawfly	jP, rP	Single webmasses were recorded near Turtle Station, Fort Frances District, and in McMeekin Twp, Kenora District.
Coleophora comptoniella (McD.) (=**betulivora** McD.) Lesser birch casebearer	wB	Observation revealed that 5% of the leaves on several 3-m trees in Drayton Twp, Sioux Lookout District, were damaged.
Conophthorus banksianae McP. Jack pine tip beetle	jP	In five areas assessed in the Ignace, Kenora and Sioux Lookout districts, attack averaged 6.1% on laterals, whereas damaged leaders averaged <1%.
Datana ministra (Drury) Yellownecked caterpillar	wB	low numbers recorded near Spooner Bay, Lac Seul, Sioux Lookout District and in Smellie Twp, Dryden District
Dioryctria zimmermani (Grt.) Zimmerman pine moth	rP	terminal shoot of one 2-m tree attacked in Drayton Twp, Sioux Lookout District
Diprion similis (Htg.) Introduced pine sawfly	wP	low numbers collected on shoreline of Barras Lk, Kenora District and Bat and Rainy lakes, Fort Frances District
Eupareophora parca (Cress.) (=**minuta** MacG.) Spiny ash sawfly	wA	5% defoliation of branches of 10-m trees in Caliper Lake Prov. Pk, Fort Frances District

(cont'd)

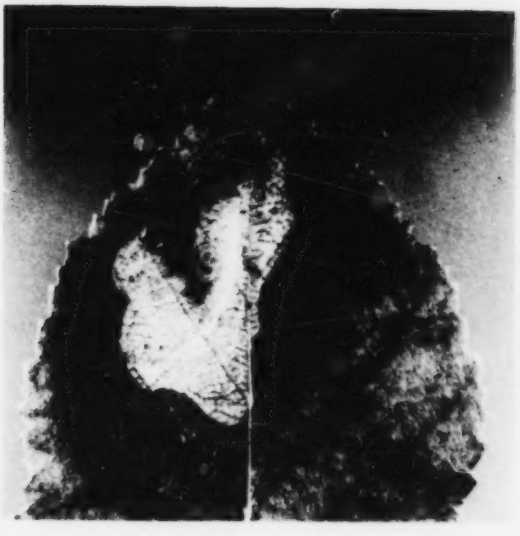
Table 14. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Fenusa pusilla (Lep.) Birch leafminer	wB	100% leafmining occurred on ornamentals in Fort Frances, Kenora and Dryden and light foliar damage was observed on roadside regeneration along Hwys 502, 17 and 11
Hyphantria cunea (Drury) Fall webworm	W	single tents recorded in Lomond Twp, Sioux Lookout District, and in Smellie Twp, Dryden District
Malacosoma californicum pluviale (Dyar) Northern tent caterpillar	wB, W, pCh	High population levels caused up to 100% defoliation on roadside host trees at widely scattered locations in the region.
Messa nana (Klug) Early birch leaf edgeminer	wB	5% of the leaves had one mine per leaf on understory host trees in a 0.1-ha area on Treaty Island, Lake of the Woods, Kenora district, representing a new Forest Insect and Disease Survey distribution record, and a westerly extension of some 1,200 km
Neodiprion abietis complex Balsam fir sawfly	bF	Assessment revealed that 50% of 4.5-m trees were attacked and defoliation averaged 13.2% at the intersection of Hwy 71 and Mayburn Road, Kenora District. Light defoliation was also observed near Thunder Lk, Dryden District. The previous light infestation recorded in the Bruce-Pakwash lakes area, Red Lake District, collapsed.

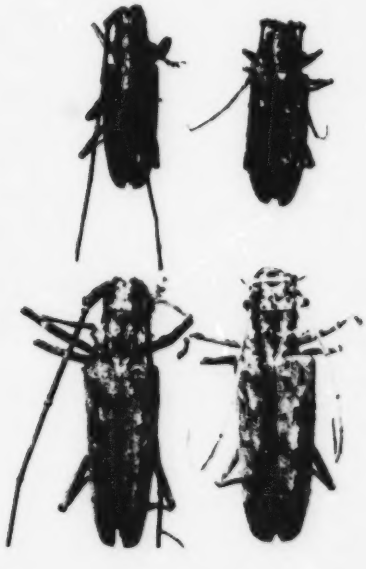
(cont'd)

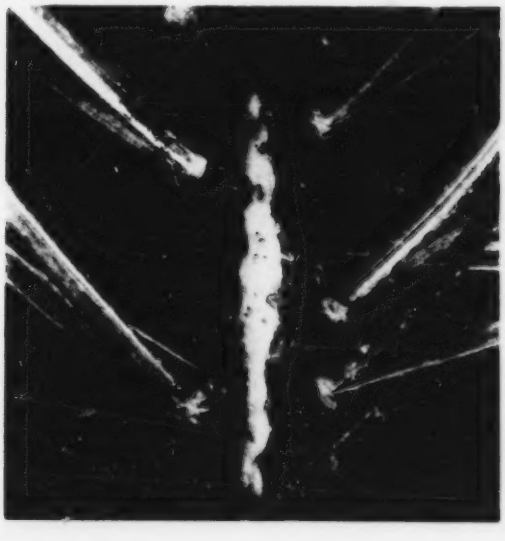
Table 14. Other forest insects (concl.).

Insect	Host(s)	Remarks
Nymphalis antiopa (L.) Spiny elm caterpillar	tA	A survey of 3-m-tall trees in block 10, Sioux Lookout District, revealed 50% defoliation on 1% of the trees. Defoliation averaged 75% on one 3-m tree near the Vermilion River bridge, Sioux Lookout District.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	A 50-tree assessment in Tovell Twp., Fort Frances District revealed that 64% of the 1.2-m trees were infested, with defoliation ranging from 2 to 90% and averaging 21.2%. Low population levels were noted in the town of Fort Frances and along a gas pipeline in Cathcart Twp, Ignace District.
Toumeyella parvicornis (Ckll.) (=**numismaticum** [P. & M.]) Pine tortoise scale	jP	A single 2.3-m tree hosted large populations near Contact Bay, Wabigoon Lk, Dryden District.

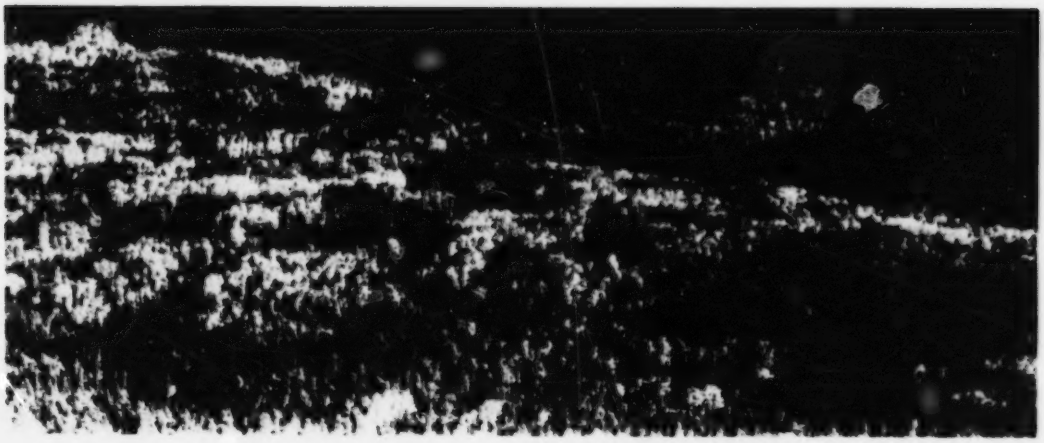


(Left) A new distribution record for early birch leaf edgeminer (*Messa nana* [Klug]) on white birch (*Betula papyrifera* Marsh.)
(Right) Defoliation of trembling aspen (*Populus tremuloides* Michx.) by early aspen leafcurler (*Pseudexentera oregonana* [Wlsm.])



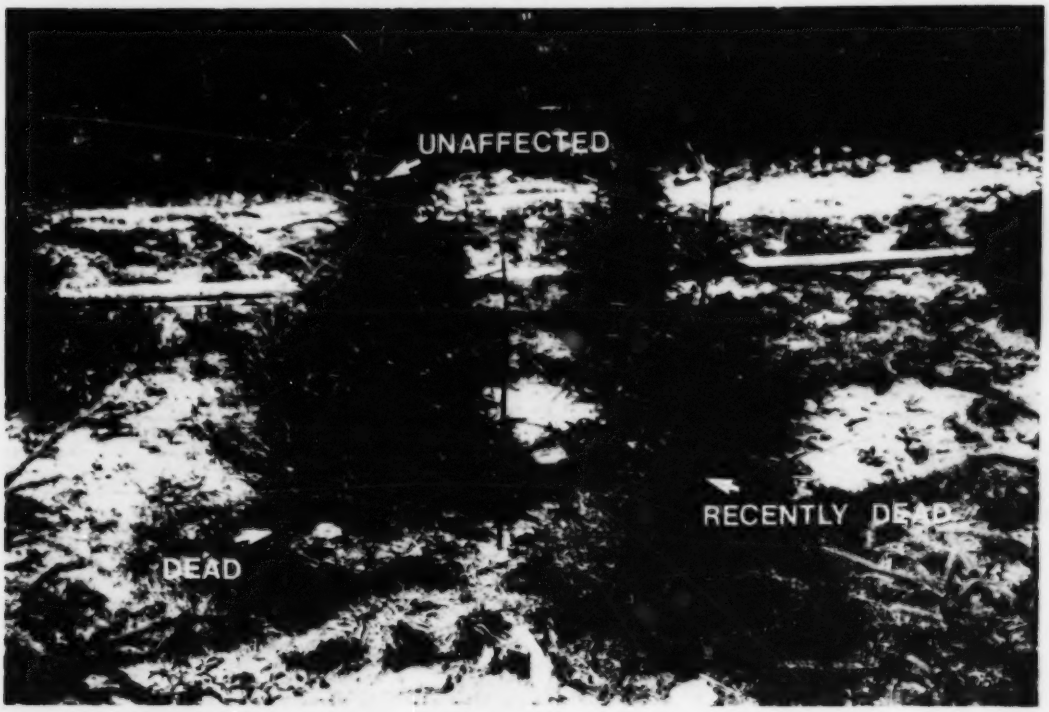


(Left) Two sawyer beetles, *Monochamus scutellatus* (Say) (top) and *M. notatus* (Drury) (bottom)
(Right) Feeding damage caused by sawyer beetles on jack pine (*Pinus banksiana* Lamb.)



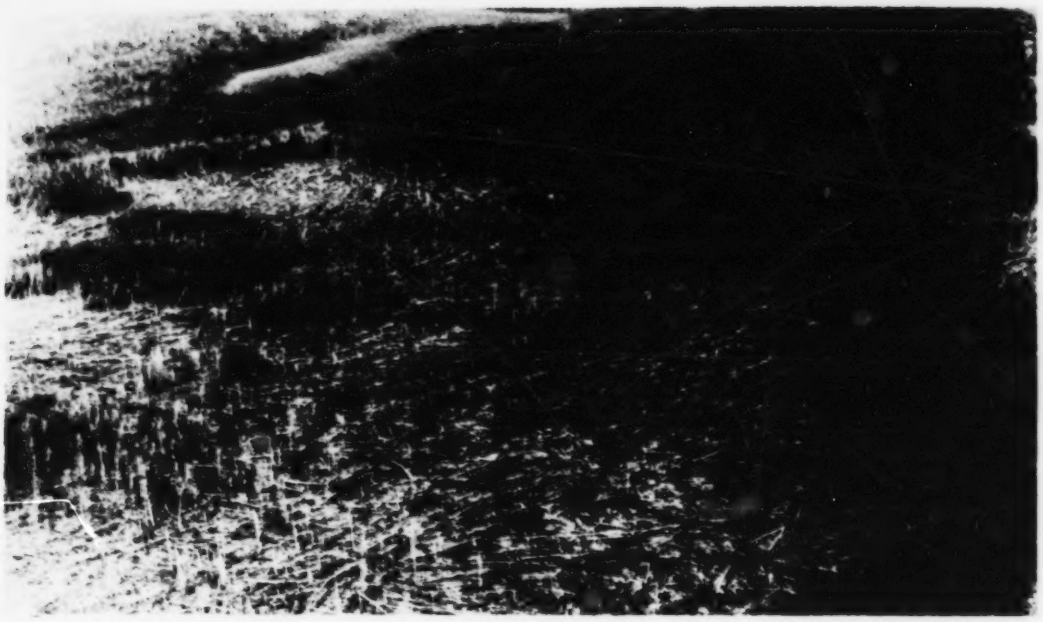
Trembling aspen (*Populus tremuloides* Michx.) moderately to severely defoliated by the forest tent caterpillar (*Malacosoma disstria* Hbn.)

(Left) Jack pine (*Pinus banksiana* Lamb.) damaged by the eastern pine shoot borer (*Eucosma gloriola* Heinr.)
(Right) Typical feeding structure made by the northern pitch twig moth (*Petrova albicapitana* [Bsk.])



Mortality caused by Armillaria root rot (*Armillaria mellea* [Vahl:Fr.] Kummer) in a cluster in a black spruce (*Picea mariana* [Mill.] B.S.P.) seed orchard

(Left) Typical damage to balsam poplar (*Populus balsamifera* L.) caused by linospora leaf blight (*Linospora tetraspora* G.E. Thompson) (Right) Fruiting and associated damage on jack pine (*Pinus banksiana* Lamb.) characteristic of sweetfern blister rust (*Cronartium comptoniae* Arthur)



Approximately 22,896 ha of forested land were damaged by severe winds in the Northwestern Region in 1988.

Digging a soil pit and removing soil samples for submission and analysis at an ARNEWS (Acid Rain National Early Warning System) plot near Sandel Lake, Sioux Lookout District

TREE DISEASES

Major Diseases

Armillaria Root Rot, **Armillaria mellea** (Vahl:Fr.) Kummer

Evaluations were carried out in 23 areas of jack pine as well as at 11 black spruce seed orchards. Results from surveys in the seed orchards are discussed in a separate write-up under SPECIAL SURVEYS.

Nothing unusual was encountered in current assessments for this root rot. Mortality levels recorded in 1988 were consistent with those reported in previous years. Surveys disclosed that of the 23 locations of jack pine ranging in height from 1.1 to 9.8 m, the disease was detected on only 6 (26%) of the plots (Table 15). In 1987, the disease was found in 27% of the plots surveyed. Recent whole-tree mortality was also the same in 1988 as in the previous year, ranging from 0.7 to 2.0%.

Gall Rust, **Endocronartium harknessii** (J.P. Moore) Y. Hirats.

The results of quantitative sampling in 10 areas of jack pine <3.0 m in height show that this rust of hard pines is a problem in young stands (Table 16). Of the 10 assessments in the small-diameter jack pine only one was negative, but in five areas the incidence of trees attacked was greater than 20% and the accompanying incidence of main-stem infection ranged from 16 to 26%.

The number of trees supporting stem galls is significant because the rust can kill the tree outright, reduce growth, predispose the tree to attack by secondary pests and make it susceptible to wind breakage when galls occur on the main stem of young trees such as those in the current survey. Related whole-tree mortality was observed off plots at several of the areas surveyed.

Balsam Poplar Leaf Diseases, **Linospora tetraspora** G.E. Thompson
Mycosphaerella populicola G.E. Thompson

Once again the entire forest component of balsam poplar (**Populus balsamifera** L.) was severely affected by one or both of linospora leaf blight (**Linospora tetraspora**) and septoria leaf spot (**Mycosphaerella populicola**). Host trees of all size classes were affected, resulting in foliar browning and premature defoliation. Ground checks at several locations in the region disclosed 100% of the sample to be affected with greater than 70% foliar infections.

Table 15. Summary of damage caused by armillaria root rot at 23 locations in the Northwestern Region of Ontario in 1988 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Current mortality (%)
Dryden District				
Aubrey[a]	3.4	1,975	150	0.0
Buller	9.3	5,000	40	0.0
Rawlinson Lk	3.5	3,200	100	0.0
Satterly Twp	1.5	3,333	10	0.7
Fort Frances District				
Hillyer Creek	1.1	5,556	20	2.0
Otter Rapids	2.5	4,630	150	0.0
Rowe Twp	8.8	3,033	1	0.0
Turtle Station	3.6	3,125	25	0.0
Ignace District				
Furniss Twp	1.6	5,685	50	0.7
Furniss Twp[a]	3.8	7,500	876	0.0
Hyndman Twp	9.4	5,555	25	0.0
Kenora District				
Broderick Twp[a]	3.6	8,333	3,650	0.0
MacNicol Twp	1.8	8,500	150	0.0
McMeekin Twp	2.9	4,546	25	0.0
Red Lake District				
Coli Lk	1.4	2,000	50	0.0
Dixie Lk Rd	2.1	2,600	30	0.7
Hwy 105, Goose Bay	1.6	9,600	100	0.0
McKenzie Bay Rd	3.0	2,800	100	0.0
Sioux Lookout District				
Dominion Lk Rd	3.1	8,300	100	0.0
Goodie Lk	1.7	3,425	25	0.0
Lomond Twp	7.3	4,545	10	0.7
Vermilion River[a]	4.6	2,490	100	0.0
Stanzhikimi Lk Rd	1.5	3,730	20	0.7

[a] observed off plots

Table 16. Summary of damage caused by western gall rust on jack pine at 10 locations in the Northwestern Region of Ontario in 1988 (counts based on the examination of 150 randomly selected trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Trees affected (%)	Trees affected severely (%)
Dryden District					
Satterly Twp	1.5	3,333	10	3.3	3.3
Fort Frances District					
Hillyer Creek	1.1	5,556	20	0.0	0.0
Otter Falls	2.5	4,630	150	24.0	11.3
Ignace District					
Furniss Twp	1.6	5,680	50	22.7	16.0
Kenora District					
MacNicol Twp	1.8	8,500	500	1.3	0.7
McMeekin Twp	2.9	4,546	25	2.0	0.0
Red Lake District					
Coli Lk	1.4	2,000	50	25.3	24.0
Goose Bay	1.6	9,600	100	10.0	4.0
Sioux Lookout District					
Goodie Lk	1.7	3,425	25	30.7	26.0
Stanzhikimi Rd	1.5	3,730	20	26.0	22.7

Table 17. Other forest diseases.

Disease	Host(s)	Remarks
Ascocalyx abietina (Lagerb.) Schläpfer-Bernhard Scleroderris canker	jP	A 500-tree survey revealed that <1% of the 1.8-m trees were affected in an area 7 km north of the Otoskwin River on the Pickle Lk Rd, Sioux Lookout District.
Coleosporium asterum (Dietel) Sydow Pine needle rust	jP	A survey near Little Clay Lk, Dryden District, revealed that three 0.1-ha pockets of 0.5-m trees experienced 100% foliar damage. A low incidence and accompanying light foliar damage was observed in regeneration throughout the region.
Cronartium coleosporioides Arthur f. sp. **coleosporioides** Orange stalactiform blister rust	jP	A main-stem infection was recorded on a 3.4-m tree in Aubrey Twp, Dryden District.
Cronartium sp. prob. **comptoniae** Arthur Stem rust	jP	Surveys revealed an incidence of 0.7% in a 25-ha area of 1.7-m trees near Goodie Lk, Sioux Lookout District, and in a 25-ha area of 3.6-m trees near Turtle Station, Fort Frances District. See the Jack Pine Plantation Survey under SPECIAL SURVEYS for additional information.
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	A 5-m tree, 0.7 km west of Wabigoon River on Hwy 17 in Wainwright Twp, Dryden District, was affected.
Leucostoma kunzei (Fr.) Munk Cytospora canker	wS	An assessment of 9-m roadside trees in Lake of the Woods Prov. Pk, Fort Frances District, disclosed whole-branch mortality on 2.0% of the trees.
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	rP	Low levels of infection were observed on young trees, Ojibway Prov. Pk, Sioux Lookout District.

ABIOTIC DAMAGE

Blowdown

At least two violent windstorms in June were responsible for widespread damage in the form of uprooted and broken trees.

A storm passed through the southern part of the region and the accompanying strong winds resulted in 11 pockets of blowdown between Wild Potato Lake and Little Turtle Lake, Fort Frances District (Fig. 11). The area of damaged black spruce, trembling aspen and jack pine totalled approximately 2,343 ha.

Another windstorm damaged black spruce, jack pine and trembling aspen in a swath starting at the Ontario-Manitoba provincial boundary in the Rickaby-Bee lakes area of Kenora district. The gale-force winds touched down again to the east in the Anishinabi-Perrault-Lac Seul lakes area of Dryden District and the Lynx Lake area of Sioux Lookout District. The storm continued east and damaged trees in the Marchington-Dominion lakes area of Sioux Lookout District and the Lake of the Bays area of Ignace District. Associated damage became apparent once more in Ignace District, where numerous pockets of windthrown trees were observed in an almost continuous path across Highway 599, east to the Sturgeon-Seseganaga lakes area and continuing into the Thunder Bay District.

Approximately 23,571 ha of forests in the region sustained typical wind damage (see photo page). Table 18 gives a breakdown of the approximate areas of blowdown by district.

The area of blowdown in the Sturgeon-Seseganaga lakes area of the Brightsands Forest, Ignace District, was visited by helicopter in early September. Wind-damaged trees at two sites in the Vista Lake area were examined for invasion by secondary insects or diseases. The results obtained from this visit are probably typical of the situation in most other areas of blowdown. The majority of windthrown trees, trembling aspen, balsam fir, black spruce, jack pine, white birch (**Betula papyrifera** Marsh.), and white spruce (in order of numerical occurrence at the two sites) were "thrown"; the entire tree, including the root system, was blown down but remained alive at the time of assessment. Aerial observation elsewhere in the area of blowdown confirmed that the majority of black spruce, the largest overall forest component damaged, was affected similarly. No evidence of attack by secondary insects or diseases was found at the two locations since the trees are still living and hence, are not attractive to such pests. Stem breakage did occur and was more common in balsam fir, jack pine and trembling aspen. Broken trees were attractive to secondary insects, and bark beetles were recovered from balsam fir and jack pine at one fly-in site.

As the majority of damaged trees in the Brightsands Forest were blown down intact and have not yet been damaged by insects, they may dry out and become unsuitable as host material for secondary pests; this would increase the time available for salvage operations.

NORTHWESTERN REGION

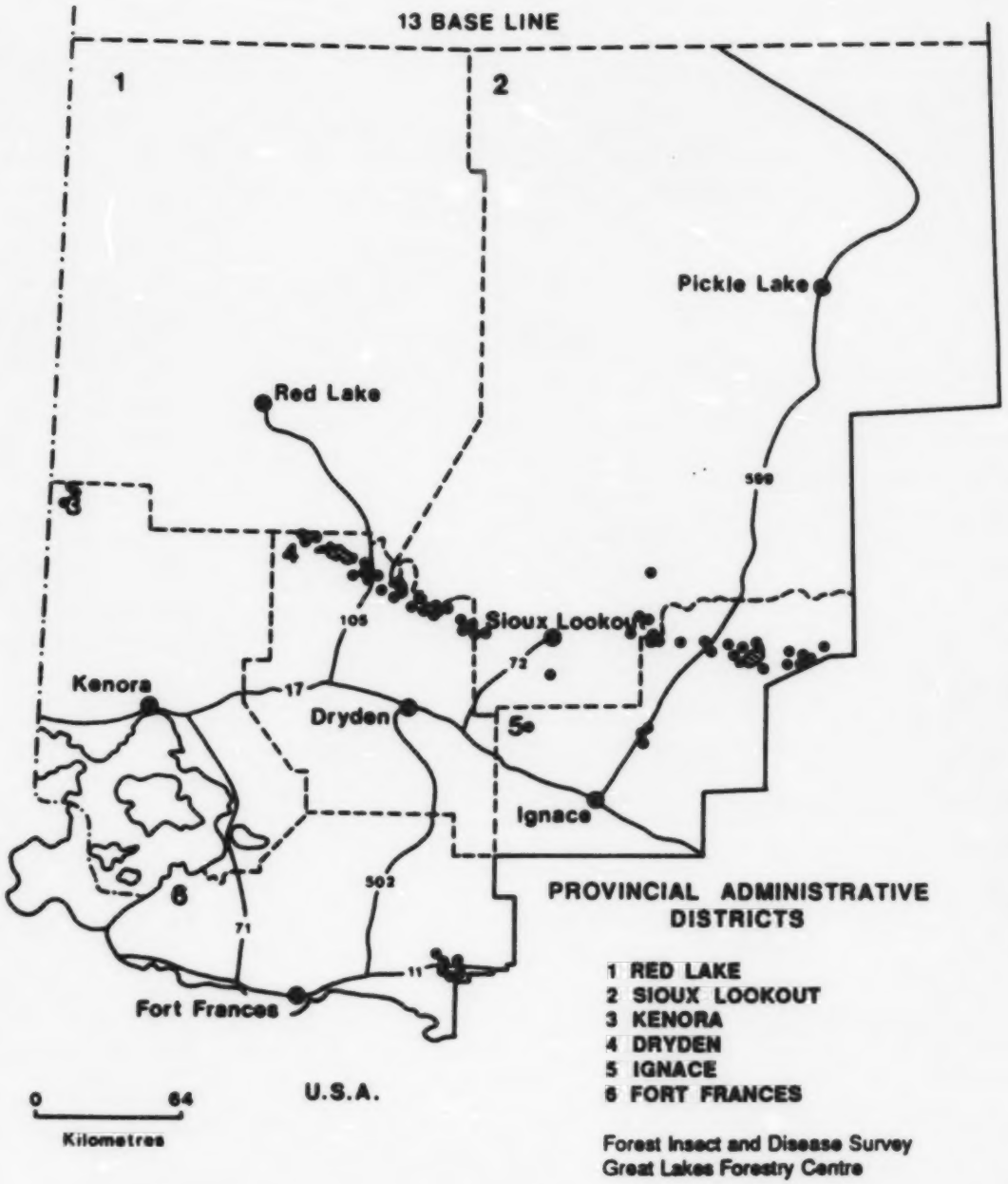


Figure 11. Blowdown

Areas within which damage occurred in 1988 ▨ or •

Table 18. Summary of wind damage in the Northwestern Region of Ontario, 1988.

District	Area of blowdown (ha)
Dryden	11,120
Fort Frances	2,343
Ignace	7,912
Kenora	160
Sioux Lookout	2,036
Total	23,571

SPECIAL SURVEYS

Jack Pine Stands

The tree species selected for special survey in 1988 was jack pine. Surveys were conducted to assess the impact of insect- and disease-related problems at 12 locations (Tables 19 and 20). Four stands were selected from each of the following height categories: 0.5 to 2.0 m, 2.1 to 6.0 m and >6.0 m. The four areas in the 2.1- to 6.0-m range were the same stands that had been selected for the establishment of the 250-tree semipermanent plots in 1982. At two of the locations, Furniss Township in Ignace District and near the Vermilion River in Sioux Lookout District, those original tagged trees that were still living were re-examined and new trees were chosen to replace those that had died. Thinning operations at the other two sites, Aubrey Township in Dryden District and Broderick Township in Kenora District, curtailed the use of the original sample so 250 new trees were tagged. The sample size in the other eight stands consisted of 150 trees. Two visits were made to each plot during the periods 3-21 June and 29 July to 30 August. Each stand was assessed to detect the presence and impact of the following selected insects and diseases.

Insects: jack pine budworm, jack pine sawflies, white pine weevil, eastern pine shoot borer, jack pine tip beetle and Swaine jack pine sawfly

Diseases: armillaria root rot, pine needle rust, scleroderris canker, western gall rust, stem rust and tar spot needle cast (**Davisomycella ampla** [J. Davis] Darker)

Except for the Swaine jack pine sawfly and scleroderris canker, all pests were encountered at one or more locations.

Other insects and diseases not specifically designated as part of the survey were also assessed when found but none were responsible for appreciable damage. These included:

Table 19. Summary of the results of a jack pine plantation survey conducted at 12 locations in the Northwestern Region of Ontario in 1988 (counts based on the examination of 150 or 250 randomly selected trees at each location).

Location	Avg ht of trees (m)	Density (trees/ ha)	Estimated area affected (ha)	Jack pine budworm		Eastern pine shoot borer		Jack pine tip beetle	White pine weevil	Jack pine sawflies
				Trees attacked (%)	Defoliation (%)	Leaders attacked (%)	Trees with laterals attacked (%)	Leaders attacked (%)	Leaders attacked (%)	Trees attacked (%)
Dryden District										
Aubrey Twp[a]	3.4	1,973	150	8.8	0.7	3.7	0.8	0.4	0.0	0.4
Buller Twp	9.3	5,000	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satterly Twp	1.5	3,333	10	13.3	0.8	4.7	0.0	0.0	2.0	0.0
Fort Frances District										
Hillyer Creek	1.1	5,556	20	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Rowe Twp	8.8	3,033	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ignace District										
Furniss Twp[a]	3.8	7,500	876	35.2	1.0	3.2	1.6	2.4	0.4	0.8
Syndman Twp	9.4	5,555	25	100.0	10.0	0.7	0.7	0.0	0.0	0.0
Kenora District										
Broderick Twp[a]	3.6	8,333	3,600	4.0	0.5	1.6	0.0	0.0	0.4	0.0
Red Lake District										
Coli Lk	1.4	2,000	50	70.7	1.0	0.7	0.0	0.0	0.0	0.0
Goose Bay	1.6	9,600	100	6.0	1.0	1.3	0.7	0.0	0.0	0.0
Sioux Lookout District										
Lomond Twp	7.3	4,545	10	100.0	5.0	0.0	0.0	0.7	0.0	0.0
Vermilion River Rd[a]	4.6	2,490	100	53.2	1.0	1.3	5.3	0.0	0.0	1.2

[a] 250-tree plot

Table 20. Summary of the results of a jack pine plantation survey conducted at 12 locations in the Northwestern Region of Ontario in 1988 (counts based on the examination of 150 or 250 randomly selected trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Needle Rust		Gall Rust		Stem Rust	Needle Cast		Armillaria Root Rot
				Trees affected (%)	Foliar damage (%)	Trees affected (%)	Severely affected (%)	Trees affected (%)	Trees affected (%)	Foliar damage (%)	Trees affected (%)
Dryden District											
Aubrey Twp[a]	3.4	1,973	150	12.8	0.8	18.4	9.2	2.8	2.4	0.6	0.0
Buller Twp	9.3	5,000	40	0.0	0.0	14.7	1.3	0.0	0.0	0.0	0.0
Satterly Twp	1.5	3,333	10	5.3	2.0	3.3	3.3	0.0	0.0	0.0	0.7
Fort Frances District											
Millyer Creek	1.1	5,556	20	2.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0
Rowe Twp	8.8	3,033	1	0.0	0.0	11.3	2.0	2.0	0.0	0.0	0.0
Ignace District											
Furniss Twp[a]	3.8	7,500	876	0.0	0.0	38.4	12.8	10.4	70.4	7.4	0.0
Syndman Twp	9.4	5,555	25	0.0	0.0	28.0	10.7	0.7	0.0	0.0	0.0
Kenora District											
Broderick Twp[a]	3.6	8,333	3,600	1.6	0.3	3.6	2.0	0.0	0.0	0.0	0.0
Red Lake District											
Coli Lk	1.4	2,000	50	0.0	0.0	25.3	24.0	0.0	0.0	0.0	0.0
Goose Bay	1.6	9,600	100	0.0	0.0	10.0	4.0	0.0	0.0	0.0	0.7
Sioux Lookout District											
Lomond Twp	7.3	4,545	10	0.0	0.0	22.0	7.3	0.0	0.0	0.0	0.7
Vermilion River Rd[a]	4.6	2,490	100	0.0	0.0	40.0	15.6	1.6	7.6	3.0	0.0

[a] 250-tree semipermanent plot established 1982

Insects: northern pitch twig moth and pine spittlebug

Diseases: comandra blister rust (**Cronartium comandrae** Peck)

Summary of Pest Problems

The jack pine budworm was the pest most commonly found in the survey. Its presence was recorded at 9 of the 12 areas assessed (75%) and the accompanying incidence of attack ranged from 4.0 to 100%. Defoliation was less than 10%. Damage caused by the eastern pine shoot borer was observed at eight locations. The highest incidence of leader attack (4.7%) was recorded in a 10-ha area in Satterly Twp, Dryden District. Low population levels of the jack pine tip beetle, which kills new shoots, were detected at three locations. White pine weevil was recorded in plots at only four locations and the accompanying incidence of attack ranged from 0.4 to 2.0%.

N. banksianae was the only species of jack pine sawfly observed in the survey. It was recorded at three locations causing only light defoliation (<1%).

Western gall rust was the most damaging pest problem found in the current survey. Main-stem galls capable of killing small-diameter trees and retarding growth were detected in 11 stands. At the 250-tree plots in Furniss Township, Ignace District, and Vermilion River area, Sioux Lookout District, 3.6% and 2.4%, respectively, of the original sample were killed by the gall rust, over a seven-year period. The incidence of trees damaged by stem rusts averaged 3.5% at five locations where it was recorded. Other than reduced growth and associated defect, these rusts do not usually pose a serious threat to a tree once it achieves a diameter of 8.0 cm. Neither tar spot needle cast nor pine needle rust were found at damaging levels. Recent whole-tree mortality of 0.7% caused by armillaria root rot was recorded at all but one of the locations where the disease was found; 2% mortality was recorded in the area near Hillyer Creek, Fort Frances District.

Jack Pine Decay and Stain Survey

A survey to determine the presence and extent of internal decay in jack pine was conducted at four of the special survey areas in the >6.0 m classification. A core sample extending completely through the tree was extracted at 15 cm above ground level from 20 randomly selected trees at each site. The lengths of sound, stained and decayed wood were measured from each core.

No stained or decayed wood was found in core samples from the 9.3-m and 8.8-m plantation trees in Buller Township, Dryden District, and Rowe Township, Fort Frances District, respectively. Only sap stain was recovered from 10% of the sample trees in Lomond Township, Sioux Lookout

District. A trace of stain was recovered from one 5.9-m tree in Hyndman Township, Ignace District. The causal agent was determined to be Ceratocystis sp., a blue-stain fungus, which probably gained entry through a wound in the stem.

Jack Pine Seed and Cone Pests

A collection of 100 second-year jack pine cones in the green succulent stage was taken during the first week of July from a stand of 9.4-m-tall trees in Hyndman Township, Ignace District, and from 15.0-m-tall trees near Dogpaw Lake, Kenora District. At least three trees were sampled and cones were taken from the upper, mid and lower cone-bearing portions of each tree. The purpose of the collection was to determine the type of pests that attack jack pine cones and their impact on seed production. Cones were submitted to the Great Lakes Forestry Centre for dissection and identification of pests. The dissection results indicated that 16% and 15% of the cones from the Ignace and Kenora sites, respectively, were damaged with an accompanying seed loss of 13% and 61% (Table 21). No diseases were encountered but the responsible insect agents and a brief description of their characteristic damage are described below:

Table 21. Summary of jack pine seed and cone damage at two locations in the Northwestern Region of Ontario in 1988 (100 cones examined at each site).

Location	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss and proportion of cones attacked (%)	
Ignace District				
Hyndman Twp	16	13.0	Unknown	(12)
			Resseliella spp.	(1)
			Petrova albicapitana	(1)
			Lepidoptera	(2)
Kenora District				
Dog Paw Lk	15	61.3	**Dioryctria** spp.	(6)
			Unknown	(4)
			Resseliella spp.	(2)
			Cydia toreuta	(1)
			Lepidoptera	(2)

Eastern pine seedworm, **Cydia toreuta** (Grt.) - These larvae feed almost entirely on the seeds.

Coneworms, **Dioryctria** spp. - Coneworms are the most important lepidopterous cone pests in North America. Developing larvae essentially hollow out the cone.

Seed midges, **Resseliella** spp. - The larvae feed on the scale surfaces within the cones.

Northern pitch twig moth - Larvae normally feed on bark and wood of branches from within a nodule of pitch. Sometimes, however, the nodule is constructed next to a developing cone and the larvae enter the cone, where they mine through scales and destroy seeds.

Lepidopterous larvae - Damage is usually confined to the exterior of the cone, which results in slightly deformed cones.

Damage caused by unknown factors - As is implied, the cause of damage, insect or mechanical, is unknown.

Black Spruce Seed Orchards

Surveys were again carried out at the 11 black spruce tree-improvement sites. As in the past, orchards were examined to detect any insect- or disease-related problem, with emphasis on recovering information on four specific problems. A comparison of the results of surveys for these pest problems in 1987 and 1988 is presented in Table 22.

Spruce budworm was again recorded in all the black spruce seed orchards; the proportion of trees attacked ranged from 4.0 to 8.6%. Associated defoliation, however, was light, not exceeding 2% in any orchard.

Over all, the average number of trees damaged by white pine weevil in the seed orchards increased from 2.6% in 1987 to 4.0% in 1988. The most significant population increase was recorded in the Vermeersch orchard, Ignace District, where 16% of the leaders were infested. Other notable increases were observed in the Beauregard and Skurban Lake seed orchards. Infested leaders were hand pruned and destroyed by OMNR staff in all of the orchards.

Armillaria root rot continues to be a problem in several of the orchards, although the incidence of recent whole-tree mortality decreased in eight orchards and remained the same in three others. The Ferguson seed orchard in Ignace District had the largest number of dead trees (3.3% recent mortality), although this figure and those obtained from the three Sioux Lookout seed orchards may be lower than the true levels of damage because sanitation efforts in the form of tree removal were per-

Table 22. A comparison of the results of surveys conducted at 11 black spruce seedling seed orchards in the Northwestern Region of Ontario in 1987 and 1988 (counts based on the examination of 150 randomly selected trees at each location).

Location	Spruce budworm						White pine weevil		Armillaria root root		Frost			
	Avg ht of trees (m)	Trees attacked (%)		Defoliation (%)			Leaders attacked (%)		Trees attacked (%)		Trees attacked (%)		Foliar damage (%)	
		1987	1988	1987	1988		1987	1988	1987	1988	1987	1988	1987	1988
Dryden District														
Melgund Twp	1.5	69.3	27.3	1.0	1.0		-	4.7	2.0	0.0	96.7	6.0	5.7	1.0
Fort Frances District														
Manion Lk	1.3	60.3	64.0	1.0	2.0		12.7	4.7	0.7	0.0	100.0	0.0	3.6	0.0
Morson Twp	1.3	5.3	4.0	1.0	1.0		2.0	0.7	6.7	0.7	68.9	0.0	1.0	0.0
Ignace District														
Ferguson	1.6	22.7	70.0	1.0	1.0		2.7	2.7	8.7	3.3[a]	53.3	34.0	1.0	1.0
Vermeersch	1.7	74.0	72.7	1.0	1.0		0.7	16.0	1.3	0.0	72.0	0.0	19.1	0.0
Kenora District														
Minnesabik	1.7	81.3	68.7	2.0	2.0		0.7	1.3	10.0	1.3	71.3	11.3	1.2	1.0
Ulster Lk	1.8	82.0	46.0	2.0	1.0		1.3	1.3	0.7	2.7	25.3	0.0	0.8	0.0
Red Lake District														
Beauregard	1.7	6.7	80.0	1.0	1.0		0.0	4.0	1.3	1.3	28.0	0.0	1.0	0.0
Sioux Lookout District														
Goodie Lk North	1.7	81.0	87.0	1.0	1.0		2.0	2.0	0.7	0.0[a]	87.0	6.0	17.0	1.0
Goodie Lk South	1.6	82.0	80.0	1.0	1.0		2.7	2.0	5.3	1.3[a]	87.3	5.3	16.5	1.0
Skurban Lk	1.6	86.7	93.3	1.0	1.0		1.3	4.7	0.7	0.7[a]	92.0	5.3	17.5	1.0

[a] sanitation program carried out prior to assessment

formed prior to the survey. In an effort to reduce losses, OMNR instituted a control program in the summer of 1988 in the Minnesabik orchard, Kenora District, in the Meglund Township orchard, Dryden District, and in the three Sioux Lookout seed orchards. Dead trees were removed from each cluster (some had been removed previously in some orchards) and both the remaining cavity and the soil around the healthy trees were drenched with Captan at a formulation rate of 13.9 grams per litre of water for the Minnesabik orchard and 22.2 grams per litre for the rest; an application rate of 9 litres per tree was used. The number of trees treated in these orchards ranged from 480 to 1,656.

Frost damage was recorded at six locations but associated foliar damage was light.

Dryden Forest Station Report

A total of 17 visits was made to the Dryden Forest Station during the 1988 field season. A number of problems were examined and a total of 38 collections was submitted to the Great Lakes Forestry Centre for examination and/or culturing. The causes of many of the submissions were undetermined, but were definitely not insect or disease related. Some of the problems encountered and, if possible, the probable causes, are listed below.

White spruce greenhouse container stock displayed browning tips and poor root development. The suspected cause was excess water or excess salt accumulation. Another problem in the same stock was a canker-like abnormality that was probably caused by an abiotic condition, perhaps heat or mechanical damage.

Several problems were encountered in the bare-root stock. Bud mortality of black spruce outplanted in May, probably caused by frost, was observed in compartment W16GT. Light tree mortality was also encountered, but except for **Fusarium** sp., which has the potential to be pathogenic, nothing was recovered from the samples of soil submitted. Soil and whole-tree submissions were taken from an adjoining compartment of white spruce that had also been outplanted in May in compartment W3 and the following diseases were collected: root rot, **Cylindrocladium floridanum** Sob. & C.P. Seym.; **Fusarium** sp.; and **Cylindrocarpon** sp.. Light mortality was also recorded in this compartment.

A problem was noted in the 2+0 jack pine in Compartment 1, especially in the western part of the block in which 43% of the trees experienced needle browning. Over all, 23% of the trees were affected in the entire compartment. Light mortality was recorded as well. The suspected cause was excess herbicide and/or winter browning.

A survey of black spruce in Compartment W5 disclosed 18% mortality as a result of frost heaving.

The cedar windbreaks were checked periodically for the presence of needle blight, **Kabatina thujae** A. Schneider & v. Arx var. **juniperi** (A. Schneider & v. Arx) Morelet, which was found at damaging levels in 1987. No evidence of this disease was found in 1988.

Damage to terminal shoots, in the form of curled shoots, often with a necrotic area underneath, was noted in the 1+0 black spruce in Compartment 9 but no accompanying tree mortality was observed. The suspected agent was **Mindarus** sp., an aphid.

Concern was expressed over dead trees among the 3+0 red pine in Compartment E13. A white mold and some mushrooms were found in association with this condition. Further investigation disclosed that the affected trees were "suppressed" and had not not received sunlight or sufficient air circulation because of the dense planting. The presence of the mold and mushrooms was also related to the dense planting, limited air circulation and moisture build up. The mold is believed to be a mycorrhizal species actually beneficial to plant development, possibly **Thelephora terrestris** Ehrh.:Fr..

Surveys done in the 2.0-m-tall Scots pine (**Pinus sylvestris** L.) revealed that 1.3% of the trees had been attacked by white pine weevil and the incidence of recent mortality caused by armillaria root rot was 1.3%. A white pine weevil assessment in the 2.0-m exotic larch (**Larix** sp.) revealed that 7.0% of the trees were attacked.

Pinewood Nematode, **Bursaphelenchus xylophilus** (Steiner & Buhrer) Nickle

As reported previously, the pinewood nematode is recognized in some countries as a serious pest problem associated with a condition called pinewilt disease, a rapid wilting and cessation of resin production in an otherwise healthy tree. Although **B. xylophilus** exists in Canada, it has only been associated with dead or dying trees that had been stressed by other factors.

Survey efforts in 1988 concentrated on installing a type of monitor plot in stands in which the nematode's presence has been confirmed or where conditions favor its occurrence. Living and dead symptomatic trees were marked at five locations in the region and these plots should provide information on the impact, if any, that this pest is having on the forest.

A total of six samples, two balsam fir, three jack pine and one black spruce, were submitted from the five plots (two samples taken from one plot) to confirm the presence of the pinewood nematode. The "r" form of the nematode was recovered from all three jack pine samples. No evidence of pinewood nematode was found in the other samples. Five additional samples from suspect trees outside the plots were also sent for identification. Both the "r" and the "m" form were recovered from a white spruce sample and the "m" form only from a sample of black spruce.

Since the pinewood nematode may be transported by bark beetles (**Monochamus** spp.), several collections of adult whitespotted sawyer beetles, **Monochamus scutellatus** (Say), were made. Two adult northeastern sawyer beetles, **Monochamus notatus** (Drury), were also submitted. Adults of other suspect vectors were also collected; these included a wood borer, **Xylotrechus** sp.; the Virginian buprestid, **Chalcophora virginiensis** (Drury); and a weevil, **Hylobius** sp. No information on the relationship between the pinewood nematode and the submitted insect collections has been received.

Acid Rain National Early Warning System (ARNEWS)

The three ARNEWS plots in the Northwestern Region are part of a nationwide network of monitoring plots established for the purpose of detecting changes in forest trees, ground vegetation and soil. Various tree species are represented on the plots: jack pine, trembling aspen and white birch at the Dance Township location, Fort Frances District; jack pine at the plot in Mafeking Township, Dryden District; and black spruce, balsam fir and jack pine near Sandel Lake, Block 10, Sioux Lookout District. Information such as branch and crown condition, current insect- or disease-related defoliation, woody-tissue damage, cone or seed damage and acid rain symptoms were recorded for each tree in the plots. Ground vegetation was also examined and collected, as certain ground plants are sensitive indicators of changes in soil acidity. There were no visible signs of damage by airborne pollutants in any of the plots; however, the following damage was recorded: 78% of the understory trembling aspen foliage was damaged by the aspen leafblotch miner (**Phyllonorycter ontario** [Free.]) in the Dance Township plot; defoliation of balsam fir and black spruce by the spruce budworm ranged from 10 to 50% in the Sandel Lake plot. As well, the entire complement of black spruce experienced 1 to 5% needle infections by the spruce needle rust (**Chrysomyxa ledi** [Alb. and Schwein.] de Bary var. **ledi**), and squirrel damage was reported on 33% of the jack pine; light branch infections were observed on 22% of the jack pine in the Mafeking Township plot.

Gypsy Moth Pheromone Traps

Two pheromone-baited traps were set out at eight of the nine provincial parks in the Northwestern region to detect the presence of gypsy moth. At Rushing River Provincial Park, 10 traps were deployed in a more intensive effort, since one adult moth was captured at this park in 1987. Two traps were also set out at Minaki Lodge because of the volume of traffic it receives each year. No adults, however, were captured in the Northwestern Region in 1988.

The gypsy moth is a serious pest problem in the southern part of the province, where it caused 33,697 ha of moderate-to-severe defoliation in 1988.

Climatic Data

Temperature and precipitation have a great deal of influence on the presence and development of insects and diseases. Daily and monthly summaries can aid in the prediction of insect development or the occurrence of abiotic conditions such as frost or drought. Table 23 summarizes weather data at three locations in the region.

Table 23. Summary of mean temperature and total precipitation at three locations in the Northwestern Region in 1980.

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
Fort Frances Airport	January	-16.9	-16.7	+0.2	30.6	25.4	-5.2
	February	-13.1	-16.7	-3.6	22.7	8.0	-14.7
	March	-5.7	-5.8	-0.1	31.6	11.0	-20.6
	April	3.8	3.8	0.0	48.5	6.7	-41.8
	May	11.0	14.4	+3.4	71.2	37.0	-34.2
	June	16.4	19.5	+3.1	101.7	137.1	+35.4
	July	19.2	19.5	+0.3	103.6	111.8	+8.2
	August	17.7	18.5	+1.2	82.6	216.1	+133.5
	September	12.2	12.1	-0.1	83.8	87.9	+4.1
	October	6.6	3.6	-3.0	50.9	22.9	-28.0
	November	-3.2	-3.2	0.0	36.8	52.0	+15.2
	December	-12.4	-13.2	-0.8	31.8	43.0	+11.2
Kenora Airport	January	-18.5	-18.6	-0.1	28.2	24.1	-4.1
	February	-14.4	-17.5	-3.1	23.0	17.5	-5.5
	March	-7.1	-6.5	-0.6	30.1	67.2	+37.1
	April	2.7	4.0	+1.3	41.9	3.0	-38.9
	May	10.5	14.5	+4.0	57.3	26.6	-30.7
	June	16.1	21.1	+5.0	83.4	68.9	-14.5
	July	19.2	21.1	+1.9	91.8	159.1	+67.3
	August	17.6	19.5	+1.9	85.9	25.7	-60.2
	September	11.6	12.2	+0.6	69.2	44.0	-25.2
	October	5.6	3.7	-1.9	40.7	52.4	+11.7
	November	-4.6	-3.6	+1.0	40.4	36.5	-3.9
	December	-14.1	-13.7	+0.4	31.2	35.8	+4.6
Sioux Lookout District	January	-19.4	-19.9	-0.5	36.0	14.1	-21.9
	February	-15.7	-19.2	-3.5	26.8	23.4	-3.4
	March	-8.3	-8.7	-0.4	35.0	98.2	+63.2
	April	1.4	2.5	+1.1	45.2	4.0	-41.2
	May	9.2	13.0	+3.8	65.8	44.1	-21.7
	June	15.2	18.8	+3.6	91.7	104.3	+12.6
	July	18.3	20.5	+2.2	93.7	117.1	+23.4
	August	16.6	17.9	+1.3	88.3	77.2	-11.1
	September	10.7	11.4	+0.7	81.6	111.2	+29.6
	October	4.7	2.5	-2.2	64.9	56.7	-8.2
	November	-5.3	-4.4	+0.9	49.9	61.1	+11.2
	December	-15.1	-15.8	-0.7	33.7	51.2	+17.5